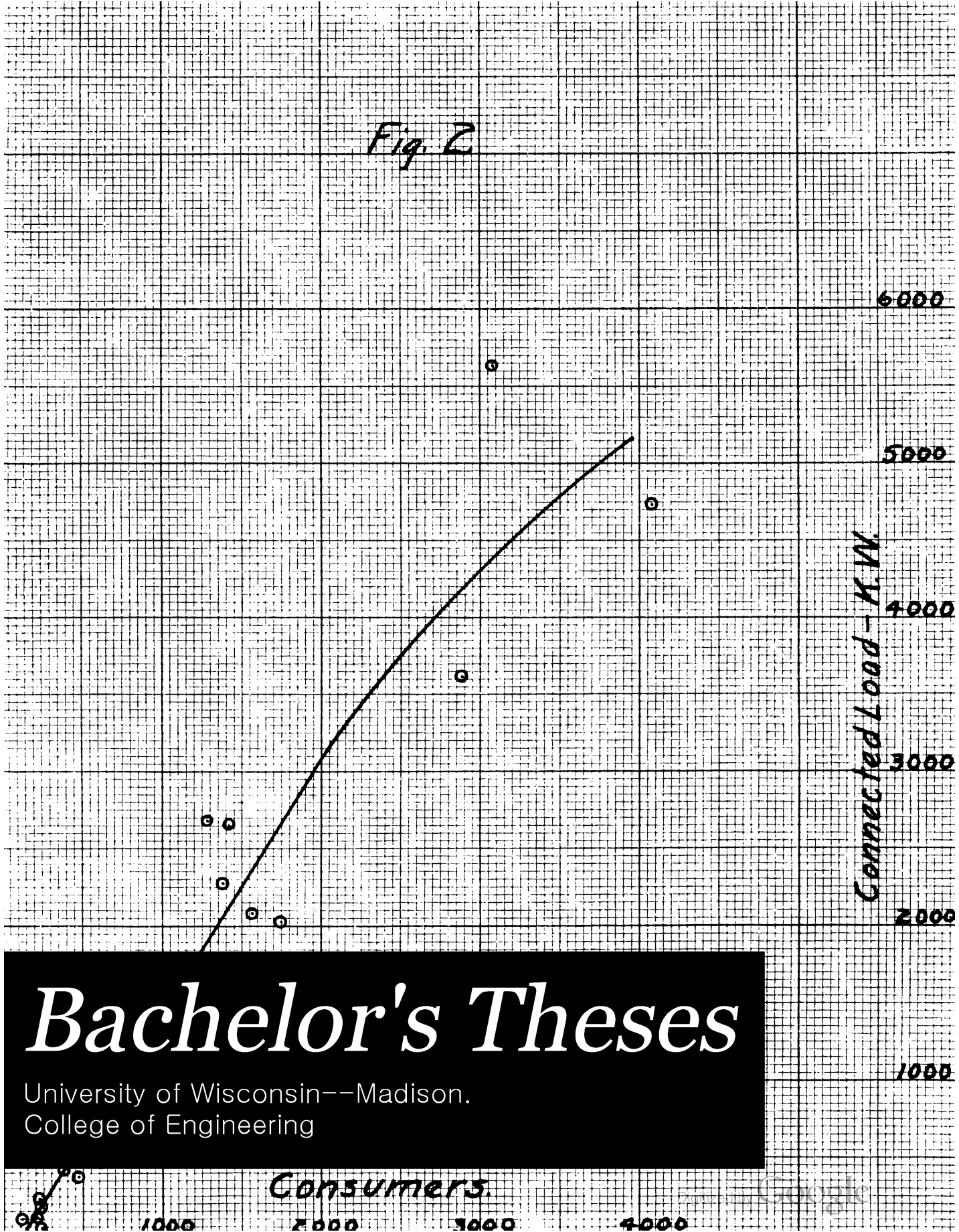

Bachelor's Theses

University of Wisconsin--Madison.
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AN INVESTIGATION OF INVESTMENTS IN ELECTRIC PUBLIC UTILITIES

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INVESTIGATION OF INVESTMENTS IN ELECTRIC UTILITIES IN WISCONSIN.

Section 1797m-3 of the Public Utilities Law passed by the Wisconsin State Legislature in 1907 states:" Every Public utility is required to furnish reasonable and adequate service and facilities. The charge made by any public utility for any heat, light, water, or power produced, transmitted, delivered, or furnished, or for any telephone message conveyed or for any service rendered or to be rendered in connection therewith, shall be reasonable and just, and every unjust or unreasonable charge for such services is prohibited and declared unlawful." In order to provide a means of determining whether the services rendered by any public utility are adequate and that the charges for such services are reasonable the legislature created the Railroad Commission and defined its powers as follows: Section 1799m-2.

"The Railroad Commission of Wisconsin is vested with power and jurisdiction to supervise and regulate every public utility in this state and to do all things necessary and convenient in the exercise of such power and jurisdiction."

One of the most important duties required of the Commission by this law, is stated in Section 1797m-5, "The Commission shall value all the property of every public utility actually used and useful for the convenience of the public etc." Since the problem of design and operation of public utilities are questions of engineering practice and judgment it was necessary that the Commission organize a competent engineering department to make appraisals to determine the value of the property used and useful for the public convenience. This engineering department is in charge of one chief engineer and his assistant and is divided into nine divisions which are as follows:

1. Railroad Valuation Division
2. Overhead Valuation Division
3. Electric Machinery & Rolling Stock Division
4. Mechanical Division
5. Meter and Gas Distribution
6. Safety Service Division
7. Gas Valuation Division
8. Gas and Electric Service Division
9. Land and Buildings Division

Since this paper deals only with Electric Utilities

we shall pay attention to the methods of proceedure of the Electric Division only. In making an inventory of an Electric Utility plant, the Engineers use the following classification.

Joint Engineering Dept. September 1911.
Wis. Tax & R.R.Commissions

CLASSIFICATION OF INVENTORY
for
ELECTRIC UTILITIES

A. LAND

A 1- Power Station Land
A 2- Substation Land
A 3- All other Lands

B. TRANSMISSION & DISTRIBUTION.

B 1- Transmission System
B 2- Distribution System
B 3- Transformers
B 4- Meters
B 5- Commercial Lamps and Lamp Equipment
B 6- Municipal Contract Lighting System

C. BUILDINGS & MISCELLANEOUS STRUCTURES.

C 1- Power Plant Buildings
C 2- Substation, Transformer Station & Storage Battery Bldgs.
C 3- General Office Buildings
C 4- Miscellaneous Buildings

D. POWER PLANT EQUIPMENT.

D 1- Steam Power Plant Equipment
D 2- Gas Power Plant Equipment
D 3- Hydraulic Power Plant Equipment
D 4- Boiler Plant Equipment
D 5- Producer Gas Equipment
D 6- Dams, Canals & Flumes
D 7- Substation, Transformer Station & Storage Battery Equipt.

E. GENERAL EQUIPMENT.

E 1- Utility Equipment
E 2- General Office Equipment
E 3- Shop Equipment
E 4- Miscellaneous Equipment

F. PAVING.

F 1- Paving over Trenching

G. MATERIAL & SUPPLIES.

G 1- Electric Line Supplies
G 2- Power Plant Supplies
G 3- General Office Supplies
G 4- Fuel
G 5- Miscellaneous Supplies

Under each of the divisions given in the classification are listed all the items of property of the utility which are actually used and useful. The values for land and buildings allowed are based on general property conditions in the city in which the plant is located. Other property is valued largely on a basis of costs obtained from five year averages compiled by the Commission. Using this cost basis the total cost new is determined to which is added twelve per cent to cover engineering, contingencies etc. during construction. When making the inventory a condition percent is placed on each item and by means of a depreciation curve the present value is obtained. Each inventory shows the total cost new and the existing value. Since only the cost new affords a means of comparison of plants this is the value used throughout this paper.

In addition to the inventories made by the Engineers, each company is required to send in a report at the end of each year showing among other things its financial accounts, amount of power generated, means of generation, number of customers served, and such data as is required by the Commission. From these reports the general operating data for the plants included in this analysis has been obtained. Effort has been made in every instance to secure the operat-

ing data for each plant as of the date of the inventory so that units could be computed on a comparative basis.

Table 1 gives a list of the utilities considered in this investigation together with the cities supplied, the date of valuation, the total cost new, and the present value.

TABLE I.

ELECTRIC PUBLIC UTILITIES VALUED BY COMMISSION.

Company	Cities Supplied	Date of Valuation
Milwaukee Elec.Ry.& Lt. Co.	Milwaukee	Jan. 1-1910
Madison Gas & Electric Co.	Madison	May 31-1911
La Crosse City Gas & Elec.Co.	La Crosse	June30-1909
Superior W. Gas & Elec.	Superior	June30-1911
Wisconsin Light Heat & Trac.Co.	Appleton,Neeneh,Menasha	June30-1909
Beloit W.Gas & Electric Co.	Beloit	Jan. 1-1909
Sheboygan Ry.& Lt.Co.	Sheboygan	June30-1910
Eastern Wisconsin Ry.& Lt Co.	Fond du Lac,No.F.F.L. Town of F.D.L.	June301910
Menominee & Marinette Lt.& Tr.Co.	Menominee,Marinette	June301909
Wausau St. Ry.Co.	Wausau,Rothchild,Schofield	june301910
Manitowoc Electric Lt.Co.	Manitowoc	July30-1908
Kenosha Gas & Electric Co.	Kenosha	July301908
Chip. Falls W.Wks.& Lt.Co.	Chippewa Falls	May 1-1908
Berlin Light & Power Co.	Berlin	May 15-1908
Red Cedar Valley Elec.Co.(Rice Lake)	Rice Lake	June30-1911
Ashland Lt.Pr.& St. Ry.Co.	Ashland	June30-1909
Burkhardt Mfg. & Elec.Pr.Co.	Hudson,Burkhardt	June30-1908
Mineral Point Elec.Lt.Co.	Mineral Point,Linden	Aug. 1-1908
C.I.Newton's Sons Co.(Sparta)	Sparta	June30-1907
Monroe Electric Lt.& pR.Co.	Monroe	Nov.15-1909

TABLE I (Continued)

ELECTRIC PUBLIC UTILITIES VALUED BY COMMISSION.

Company	Cities Supplied	Date of Valuation
Kaukauna Gas,Elec.Lt.& Pr.Co.	Kaukauna	Jan.301911
DePere Lt. & Pr.Co.	DePere	Dec. 1-1910
Antigo El.Lt.Co.	Antigo	June 1-1909
Equitable Elec.Lt.Co.(L.Geneva)	Lake Geneva	June30-1911
Municipal W.& Lt.Co.	Jefferson	Apr.30-1910.
Whitewater El.Lt.Co.	Whitewater	Apr. 1-1910
MuN.El.Lt.Plant(Richland Center)	Richland Center	June30-1911
Viroqua El.Lt.& Ry.Co.	Viroqua	June30-1911
Ripon Lt.& Water Co.	Ripon	Jan. 1-1907
Darlington El.& W.Pr.Co.	Darlington	Mar.15-1909
Rhinelander Lt.Co.	Rhinelander	July15-1911
Waupaca El.Lt.Co.	Waupaca	June30-1910
MuN.W.& Lt.Co.(Bayfield)	Bayfield	Feb.25-1909
United Ht.Lt.& Pr.Co.(Delavan)	Delavan	Apr. 1-1910
No.Milwaukee Lt.& Pr.Co.	No.Milwaukee	Feb.30-1909
Doegeville El.Lt. & Pr.Co.	Dodgeville	Apr.30-1908
Mellen El.Lt.& Pr.Co.	Mellen	July 1-1910
Tomah El.& Telephone Co.	Tomah	June30-1906
Duck Creek Lt.& Pr.Co.	Rio, Wyocena	Oct.11-1910
Twin City El.Co.(Hurley)	Hurley,Ironwood	June30-1910
Bloomer El.Lt.Plant	Bloomer	Jan.15-1910
Menominee Falls El.Co.	Menominee Falls	Feb.12-1908

TABLE I (Continued)

ELECTRIC PUBLIC UTILITIES VALUED BY COMMISSION.

Company	Total Cost New	Present Value
Milwaukee El.Ry.& Lt.Co.	$4,367,418	$3,494,310
Madison Gas & El.Co.	640,048	538,331
LaCrosse City Gas & El.Co.	545,437	434,911
Superior W.Gas & El.	414,606	315,057
Wis. Lt.Heat & Trac.Co.	267,914	230,571
Beloit W. Gas & El.Co.	210,679	177,720
Sheboygan Ry.& Lt.Co.	184,193	159,957
Eastern Wis.Ry.& Lt.Co.	178,138	141,400
Menominee & Marinette Lt.& Tr.Co.	167,567	108,945
Wausau St.Ry.Co.	167,052	153,503
Manitowoc El.Lt.Co.	110,137	76,888
Kenosha Gas & El.Co.	107,856	88,257
Chip.Falls W.Wks.& Lt.Co.	94,227	63,218
Berlin Lt.& Power Co.	88,726	70,193
Red Cedar Valley El.Co.(Rice Lake)	83,057	74 ,084
Ashland Lt.Pr.& St.Ry.Co.	80,079	57,501
Burkhardt Mfg.& El.Pr.Co.	79,934	64,068
Mineral Point EL.Lt.Co.	69,007	58,832
O.I.Newton's Sons Co.(Sparta)	64,060	46,795
Monroe El.Lt & Power Co	63,762	56,283

TABLE I (Continued)

ELECTRIC PUBLIC UTILITIES VALUED BY COMMISSION.

Company	Total Cost New	Present Value
Kaukauna Gas.El.Lt.Co.	63,304	47,320
De Pere Lt.& Pr.CO.	63,278	48,824
Antigo Elec.Lt.Co.	62,772	46,829
Equitable El.Lt.Co.	54,063	37,175
Mun.E & Lt.Co.	48,727	39,821
Whitewater El.Lt.Co.	43,446	33,226
MuN.El.Lt.Plant(Richland Ctr.)	42,093	34,721
Viroqua El.Lt.& Ry.Co.	36,168	27,952
Ripon Lt.& Water Co.	35,804	26,894
Darlington Elec.& W.Pr.Co.	35,795	26,998
Rhinelader Lt.Co.	35,747	28,492
Waupaca El.Lt.Co.	34,05o	25,017
MuN.W.& Lt. Co.(Bayfield)	31,643	20,346
United HT.Lt.& Pr.Co.	31,559	20,5o2
No.Milw.Lt.& Pr.Co.	28,890	20,567
Dodgeville El.Lt.& Pr.Co.	25,138	17,852
Mellen EL.Lt.& Pr.Co.	24,2o7	19,629
Tomah El.& Tel.Co.	23,090	19,629
Duck Creek Lt.& Pr.Co.	19,766	16,8o7
Twin City El.Co.(Hurley)	17,584	14,26o
Bloomer El.Lt.Plant	17,149	14,582
Menominee Falls El.Co.	13,472	13,134

It will be observed that the utilities are placed in the order of their cost new, ranging from a maximum of $4,267,418 for the Milwaukee Electric Railway and Light Company to $13,472 for the Menominee Fall Electric Company. Of the forty two plants appraised, twelve have a cost new over $100,000, fifteen from $40,000 to $100,000 and fifteen below $40,000. Since the plants are of widely varying ages, it is apparent that the present values would not necessarily range in the same order as that of the cost new. The maximum present value $3,494,310 is that of the Milwaukee Electric Railway and Light Company while the minimum present value of $13,134 is that of the Menominee Fall Electric Company. From the difference of the dates of valuation it is obvious that the slight differences in the present value may also arise. Table No.2 giving the date when the company first began to sell, the age of the plant at the time of valuation, the ratio of present value to cost new in percent and the cost per K.W. follows

TABLE II.
RATIO OF PRESENT VALUE TO COST NEW
AND
INVESTMENT PER K.W.CAPACITY.

Name of Company	Date began to sell	Age of Plant at Present	Ratio Pres. Value Cost New	Cost per K.W.Ca.
The Milwaukee El.Ry.& Lt.Co.			80.0	296
Madison Gas & El.Co.	1896	15	84.0	200
La Crosse City Gas & Elec.Co.	1901	8	79.6	228
Superior W.Lt.& Pr. Co.	1899	22	76.1	346
Wis.W.Lt.& Pr.Co.(Appleton)	1902	7	85.8	268
Sheboygan Ry.& Lt.Co.	1895	15	86.9	122.8
Beloit Water Gas & El.Co.	1891	18	84.6	234
Wausau St.Ry.Co.	1908	2	92.0	98.2
Eastern Wis.Ry.& Lt.Co.	1903	7	79.5	108.8
Kenosha Gas & El.Co.	1909	1	82.0	215.5
Manitowoc Elec.Lt.Co.			70.0	244.8
Menominee & Marinette Lt.& Tr.Co.			65.0	134.2
Chip.Falls W.Wks.& Lt.Co.			67.2	172.5
Ashland Lt.Pr.& St.Ry.Co.			72.0	333
Red Cedar Valley El.Co.(Rice Lake)	1909	2	89.2	259.5
Burkhardt Mfg.& El.Pr.Co.(Hudson)	1907	1	80.3	296
Equitable El.Lt.Co.(Lake Geneva)	1897	14	68.6	142.5
Mineral Point El.Lt.Co.	1898	17	66.0	172.2
O.I.Newton's Sons Co.(Sparta)	1889	18	73.2	189
Monroe El.Lt.& Pr.Co.	1889	21	88.4	255
Kaukauna Gas & El.Lt.& Pr.Co.	1906	5	74.8	204.5

TABLEII.
RATIO OF PRESENT VALUE TO COST NEW
AND
INVESTMENT PER K.W.CAPACITY.

Name of Company	Date began to sell	Age of Plant at Present	Ratio Pres. Value Cost New	Cost per K.W.Ca.
De Pere Lt.& Pr.Co.	1893	17	77.2	240
Antigo Elec.Lt.Co.	1909		74.7	125.5
Mun.W.& Lt. Dept.(Jefferson)			81.8	324
Ripon Lt. & W.Co.	1894	14	75.2	202
Whitewater Elec.Co.	1886	24	76.6	144
Mun.El.Lt.Plant (Richland Center)			82.5	168
Waupaca El.Lt.& Ry.Co.	1898	12	73.5	105
Viroqua El.Light Co.	1894	17	77.0	403
Darlington El.& W.Pr.Co.	1897	2	75.4	286
Rhinelander Light Co.	1909	2	79.8	
Mun.W.& Lt. Plant (Bayfield)	1895	6	64.4	158
United Lt.Ht.& Pr. Co.(Delavan)	1910	1	64.9	197
No.Mil. Lt. & Pr.Co.	1905	4	71.0	195
Dodgeville Elec.Lt.& Pr.Co.	1907	1	71.0	296
Mellen LT.& W.Co.	1901	9	81.0	403
Tomah Elec.& Tel.Co.	1908	2	88.9	110
Duck Creek Lt.& Pr.Co.			85.0	328
Bloomer El.Lt.Plant	1911	1	85.4	381
Menominee Falls El.Co.	1907	1	97.7	224
Minimum			64.4	98.2
Maximum			97.7	403.0
Average			76.6	216.0
Median			74.7	204.5

This table shows that the age of the plants from the time they first began to sell electricity up to the date of valuation varies from one to twenty four years. With the exception of one plant, all those whose age is less than three years are above the median in ratio of present value to cost new, and all but two, above the median in cost per K.W. Capacity. Of those fourteen or more years of age fifty per cent are below the median. This would seem to indicate that the cost of plants of a later date are somewhat higher than those of older design. The reason for this may be found in the fact that although materials and apparatus have not increased in value in the last ten or more years, plants are installing better apparatus and much more auxiliary machinery in an effort to obtain higher efficiency. The cost new per K.W. capacity varies from a maximum of $403.00 to a minimum of $28.20 with an average of$216. The majority of the plants follow the average closely, the median being $204.50. This result seems to be somewhat higher than the values usually given in text books, etc.In ratio of present value to cost new the variation was comparatively small, from 64.4 to 97.7 with an average of 76.6 and median of 74.7. These values indicate that this figure of 74.7 can be relied

upon as an average value of this ratio.

Table No.3 showing the population of cities supplied, method of generation, station capacity and out put follows.

TABLEIII.
GENERAL DESCRIPTIVE DATA.

Company	Pop.of Cities Supplied	Method of Generation	Stat. Cap.K.W.	Output in K.W.H.
The Milw.El.Ry.& Lt.Co.	373,857	Steam	14,735	46,231,871
Madison Gas & El.Co.	25,531	Steam &Gas	3,200	4,787,544
La Crosse City Gas &El.Co	30,417	" "	2,395	4,138,250
Sup.Wat.Lt.& Pr.Co.	40,384	Steam	1,200	1,613,931
Wis.Tr.Lt.Ht.& Pr.Co.	28,580	Hydr.&Steam	1,000	1,769,367
Sheboygan Ry.& Lt.Co.	26,398	Steam	1,500	3,409,608
Beloit W.Gas & El.Co.	15,125	Hydr.&Steam	900	1,415,257
Wausau St.Ry.Co.	11,449	" "	1,700	3,160,620
Eastern Wis.Ry.& Lt.Co.	28,000	Steam	1,635	2,893,679
Kenosha Gas. El.Co.	21,371	Steam	500	775,000
Manitowoc El.Lt.Co.	13,027	Steam &Gas	450	768,983
Menominee & MarinetteCo.	19,646	Steam	1,245	1,550,869
Chip.Falls W.W.& Lt.Co.	8,893	Hydraulic	540	#1,000,000
Ashland Lt.Pr.& St.Ry.Co.	11,594	Steam	240	
Berlin Lt.& Pr.Co.	4.636	Steam	580	
Red Cedar Valley El.Co.	3,968	Hydraulic	320	318,390
Burkhardt Mfg.& El.Co.	2,810	Hydraulic	269	556,260
Equitable El.Lt.Co.	3,579	Hydr. & Steam	380	362,432
Mineral Point El.Lt.Co.	3,515	Steam	400	
O.I.Newton Sons & Co.	3,973	Hydr. & Steam	337	

Estimated

TABLE III (Continued)
GENERAL DESCRIPTIVE DATA.

Company	Pop. of Cities Supplied	Method of Generation	Stat. Cap. K.W.	Output in K.W.H.
Monroe El.Lt.& Pr.Co.	4,410	Steam	250	274,830
Kaukauna Gas El.Lt.& Pr.Co.	4417	Hydr.& Steam	309	
De Pere Lt.& Pr.Co	4,477	Hydr.	310	303,841
Antigo El.Lt.cO.	7,196	Steam	500	579,310
Mun.Wat.& Lt.Co.(Jeff)	2,582	Steam	150	97,806
Ripon Lt.& W.Co.	3,739	Steam	177	112,192
Whitewater El.Lt.Co.	3,224	Steam	300	122,285
Mun.El.Lt.Co.(Rich.Ctr.)	2,652	Steam	250	161,100
Waupaca El.Lt.& Ry.Co.	2,789	Steam&Gas	325	215,188
Viroqua El.Lt.Co.	2,059	Steam&Gas	90	97,302
Darlington El.& W.Pr.Co.	1,808	Hydr.&Steam	125	
Rhinelander Lt.Co.	5,637	Steam		
Mun.W.& Lt.Co.(Bayfield)	2,692	Steam	200	142,000
United Ht.Lt.& Pr.Co.	2.450	Steam	160	95,508
No.Milw.Lt.& Pr.Co.	1,860	Sream	148	28,388
Dodgeville El.Lt.& Pr.Co.	1,791	Steam	85	57,500
Mellen Lt.& W.Co.	1,833	Hydr.&Steam	60	80,127
Tomah El.& Tel.Co.	3,419	Steam	210	
Twin City El.Co.(Hurley)	15,000	Steam	334	
Duck Creek Lt.& Pr.Co.	1,129	Gas&Hydr.	60	
Bloomer El.Lt. Plant	1,204	Hydraulic	45	
Menominee Falls El.Co.	919	Gas	60	

Table No.3 shows the great variation in population of the cities supplied, the population ranging from 919 inhabitants of Menominee Falls, supplied by the Menominee Falls Electric Co. to 373,857 inhabitants of Milwaukee, supplied by the Milwaukee Electric Railway and Light Co. Thirty two of the forty two companies considered, serve cities having a population of less than 20,000. As is to be expected the majority are steam plants, twenty two of the plants generate their power by steam, eight by hydraulic and steam, five by hydraulic alone, five by steam and gas, one by hydraulic and gas, and one by gas. The maximum station capacity is 14,735 K.W. of the Milwaukee Electric Railway and Light Company and the minimum of 46 K.W. that of the Bloomer Electric Light Plant. The output ranges from 57,500 K.W.H. to 46,231,871 K.W.H. The data shows that some of the companies did not record their K.W.H. output this being due to the fact that the power was sold unmetered or simply at a flat rate.

Table No.4 giving the connected load, the demand, and the number of consumers follows.

TABLE 4.

CONNECTED LOAD DEMAND & CONSUMERS.

Name of Company	Connected Load in K.W. Light	Power	Total	Max. Inst. Demand.
The Milwaukee El.Ry.& Lt.Co.	17,760	6,220	23,980	10,055
Madison Gas & Electric Co.			4,741	1,994
La Crosse City Gas & El.Co.	3,812	1,816	5,628	1,700
Superior W.Lt.& Pr.Co.	2,616	996	3,616	950
Wis.Tr.Lt.Ht.& Pr.Co.	1,982	670	2,652	800
Sheboygan Ry.& Lt.Co.	1,683	525	2,208	1,060
Beloit W.Gas & Elec.Co.	968	572	1,540	700
Wausau St.Ry.Co.	1,167	500	2,667	
Eastern Wis Ry.& Lt.Co.	1,500	510	2,010	1,055#
Kenosha Gas & El.Co.	653	152	805	396
Manitowoc El.Lt.Co.	1,177	66	1,243	372
Menominee & Marinette Lt.& Tr.Co.	1,551	726	2,278	
Chippewa Falls W.Wks.& Lt.Co.	444	153	597	300
Ashland Lt.Pr.& El.Ry.Co.				
Berlin Light & Power Co.	253	490	753	505
Red Cedar Valley El.Co.	359	11 2	472	145
Burkhardt Mfg.& El.Pr.Co.	326	52	378	220
Equitable El.Lt.Co.	683	112	796	160
Mineral Point El.Lt.Co.				110
O.I.Newton Sons Co.	652	137	789	321
Monroe El.Lt.& Pr.Co.	375	123	498	248
Kaukauna Gas El.Lt.& Pr.Co.	579	196	775	261

Estimated

TABLE 4. (Continued)

CONNECTED LOAD DEMAND & CONSUMERS.

Name of Company	Consumers		
	Light	Power	Total
The Milwaukee El.Ry.& Light Co.	7,457	160	7,617
Madison Gas & El.Co.	3,822	247	4,069
La Crosse City Gas& EL.Co.2	2,858	215	3,073
Wis.Tr.Lt.H.& Pr.Co.	1,284	134	1,418
Sheboygan Ry.& Lt.Co.	1,430	125#	1,555
Beloit W.Gas & El.Co.	743	43	786
Wausau St.Ry.Co.	1,218	68	1,286
Eastern Wis.Ry.& Lt.Co.	1,599	150	1,750
Kenosha Gas & El.Co.	538	50	588
Manitowoc El.Lt.Co.	1,201	20	1,221
Menominee & Marinette Lt.Co.	1,298	77	1,375
Chippewa Fall W.& Lt.Co.	356	29	385
Ashland Lt.& El.Ry.Co.	649	3	652
Berlin Lt.& Pr.Co.	269	50	319
Red Cedar Valley El.Co.	527	96	623
Burkhardt Mfg.&El.Pr.Co.	481	8	489
Equitable El.Lt.Co.	566	55	621
Mineral Point El.Lt.Co.	206	7#	213
O.I.Newtons Sons Co.	303	26	329
Monroe El.Lt.& Pr.Co.	492	13	505
Kaukauna Gas El.Lt.& Pr.Co.	448	27	475

#Estimated

TABLE 4 (Continued)

CONNECTED LOAD DEMAND & CONSUMERS

Name of Company	Connected Load in K.W. Light	Power	Total	Max. Inst. Demand
De Pere Lt.& Pr.Co.	562	492	1,054	175
Antigo El.Lt.Co.	500	15	515	295
Mun.W.& El.Lt Dept.(Jefferson)	41		41	60
Ripon Lt.& W.Co.	240		241	115
Whitewater El.Co.	419		419	108
Mun.El.Plant (Richland Center)	28	17	45	
Waupaca El.Lt & Ry Co.				
Viroqua El.Lt.Co.				74
Darlington El.& Pr.Co.			196	106
Rhinelander Lt.Co.	54	44	98	
Mun.W.& Lt.Plant (Bayfield)	220		220	100
United Ht.& Pr.Co.(Delavan)			275	104
No.Milw.Lt.& Pr.Co.	118	53	171	100
Dodgeville El.Lt.& Pr.Co. 2	60		60	45
Mellen Lt.& Water Co.			50	
Tomah El.& Tel.Co.				
Twin City El.Co.				
Duck Creek Lt.& Pr.Co.	40		40	50
Bloomer El.Lt.Plant			50	308
Menominee Falls El.Co.				

TABLE 4 (Continued)

CONNECTED LOAD DEMAND & CONSUMERS.

Name of Company	Consuners		
	Light	Power	Total
De Pere Lt.& Pr.Co.	486	30	516
Antigo El.Lt.Co.	971	42	1,013
Mun.W.& Lt.Dept.(Jefferson)	248		248
Ripon Lt. & W.Co.	221	3	224
Whitewater El.Co.	388		388
Mun.El.Plant (Richland Center)	349	6	355
Waupaca El.Lt.& Ry.Co.	317		317
Viroqua El.Lt.Co.	248	15	263
Darlington El.& Pr.Co.2	239		239
Rhinelander Lt.Co.	576	41	617
Mun.W.& Lt. Plant (Bayfield)	211		211
United Heat & Pr.Co.(Delavan)			310
No.Milwaukee Lt.& Pr.Co.	100	7	107
Dodgeville E.Lt.& Pr.Co.	100		100
Mellen Lt.& Water Co.	138	1	139
Tomah El.& Tel.Co.			200
Twin City El.Co.	292		292
Duck Creek Lt.& Pr.Co.	58		58
Bloomer El.Lt.Plant	105		105
Menominee Fall El.Plant	82		82

This table shows the connected load consumers and demand data obtained from the yearly reports sent in to the Commission by the companies. With the exception of eleven of the larger plants none have more than seven hundred suscribers the minimum number being 58 for the Duck Creek Light and Power Co. The Milwaukee Electric Light and Power Co. has by far the largest number of suscribers, 7,617, with the Madison Gas and Electric Co. leading all the other companies with 4,069.

The connected load data shows that with the exception of the Milwaukee plant the maximum value is 5,628 K.W. for the LaCrosse City Gas and Electric Company and the minimum 40 K.W. for the Duck Creek Plant. Most of the compamies have a connected load less than 1,000 K.W. the median being 597 K.W.

Table 5 showing the distribution of valuation by groups follows.

TABLE 5.
DISTRIBUTION OF VALUATION BY GROUPS.

Company	Land	Dist. System	Power Plant Equip.	Buildings & Miscellaneous Structures
Milwaukee El.Ry.& Lt.Co.	236,900	1,910,685	1,030,065	442,442
Madison Gas & El.Co.	14,330	144,535	223,606	50,796
La Crosse City Gas &El.Co.	11,555	244,479	169,205	36,257
Superior W.Lt.& Pr.Co.	4,114	192,393	102,482	35,595
Wis.Tr.Ht. & Pr.Co.	10,962	122,396	88,824	44,281
Sheboygan Ry.& Lt.Co.	501	104,522	55,079	23,118
Beloit W.& Gas Co.	7,028	73,360	65,399	30,239
Wausau St.Ry.Co.	2,806	83,274	52,258	27,432
Eastern Wis.Ry.&Lt.Co.	1,427	79,194	63,436	10,380
Kenosha Gas & El.Co.	12,097	45,138	42,241	6,136
Manitowoc El.Lt.Co.	4,500	50,385	36,067	4,710
Menominee & Marinette Lt.Co.	4,248	80,863	64,995	17,403
Chip.Falls W.W.& Lt.Co.	304	35,074	30,239	6,746
Ashland Lt.Pr.&St.Ry.Co.	495	47,912	26,963	3,989
Berlin Lt.& Pr.Co.	1,794	37,781	35,454	4,846
Red Cedar Valley El.Co.	8,100	11,284	18,260	27,619
Burkhardt Mfg.& El.Pr.Co.	8,050	18,529	18,927	21,753
Equitable El.Lt.Co. (Lake Geneva)		31,193	20,300	
Mineral Point El.Lt.Co.	200	12,409	13,491	3,898
O.I.Newton Son's Co.(Sparta)	2,60015	15,095	6,322	5,372

TABLE 5(Continued)
DISTRIBUTION OF VALUATION BY GROUPS.

Company	Land	Dist System	Power Plant Equip.	Buildings & Miscellaneous Structures
Monroe El.Lt.& Pr.Co.	4,000	23,294	19,985	7,167
Kaukauna Gas El.Lt.& Pr. Co.		24,787	15,449	10,352
De Pere Lt.& Pr.Co. Not included---		28,351	15,762	10,873
Antigo El.Lt.Co.	2,000	29,129	14,896	2,341
Mun.W.& Lt.Dept.(Jefferson)	5,325	12,579	11,746	11,431
Ripon Lt.& W.Co.	876	14,529	13,160	6,430
Whitewater EL.Lt.Co.	Leased---	15,512	16,843	3,735
Mun.El.Lt.Plant(Rich.Ctr.)	750	16,547	12,942	4,972
Waupaca El.Lt.& Ry.Co.	3,935	11,615	12,893	4,582
Viroqua El.Lt.Co.	900	10,465	10,672	5,164
Darlington El.& W.Pr.Co.		8,308	9,669	
Rhinelander Lt.Co.	500	22,204	2,649	3,000
Mun.W.& Lt.Plant (Bayfield)	706	11,680	10,958	3,817
United Ht.Lt.& Pr.Co.	500	11,329	10,425	2,452
No.Mil. Lt.& Pr.Co.	2,935	9,295	9,432	1,752
Dodgeville El.Lt.& Pr.Co.	300	6,501	10,956	2,598
Tonah El.& Tel.Co.	40	9,055	3,211	2,488
Twin City El.Co.(Hurley)	32	8,313	6,740	21213
Mellen Lt.& W.Co.	1,740	5,298	3,358	9,162
Duck Creek Lt.& Pr.Co.	5,000	3,215	5,313	3,940
Bloomer El.Lt.Plant	750	5,979	5,232	5,212
Menominee Fall El.Plant	650	2,117	7,006	1,377

TABLE 5(Continued)
DISTRIBUTION OF VALUATION BY GROUPS.

Company	Office Furniture & Appliances	Tools	Horses Wagons Misc.	Total
Milw.El.Ry. & Lt. Co.				3,706,803
Madison Gas.& El.Co.	2,348	1,918	1,217	443,158
La Crosse City Gas & El.Co.	1,558	2,905	270	466,141
Sup.W.Lt.& Pr.Co.	1,374(1)	6,666		342,624
Wis.Tr. L.H.& Pr.Co.	805	421	225	267,914
Sheboygan Ry.& Lt.Co.		973		184,193
Beloit W.Gas & El.Co.	979	1,464	141	178,610
Wausau St.Ry.Co.	972			167,052
Eastern Wis.Ry.& Lt.Co.	808	205		155,450
Kenosha Gas & El.Co.	1,398	596	250	107,956
Manitowoc El.Lt.Co.		476		96,138
Menominee & Marinette Lt.& Tr. Co	426	632		167,567
Chip.Falls W.W.& Lt.Co.	890	2,043	477	75,773
Ashland Lt.Pr.& St.Ry.Co.	307	370	43	80,079
Berlin Lt.& Pr.Co	426	138	322	70,761
Red Cedar Valley El.Co.	231	460		65,954
Burkhardt Mfg.& El.Pr.Co.	41	106		67,406
Equitable El.Lt.Co.	1,012	1,119	439	54,063
Mineral Point El.Lt.Co.	82	157	530	30,767
O.I.Newton Son's (Sparta)	243	233		29,865

(1) Includes repair shop, miscellaneous tools,etc. Horse charged to Gas Dept.

TABLE 5 (Continued)
DISTRIBUTION OF VALUATION BY GROUPS.

Company	Office Furniture Appliances	Tools	Horses Wagons Misc.	Total
Monroe El.Lt.& Pr.Co.	103	329		54,878
Kaukauna Gas.Elec.Lt. & Pr.Co.	553	339		51,480
De Pere Light & Pr.Co.	922	590		56,498
Antigo El.Light Co.	426	690	170	49,652
MuN.W.& Lt.Dept.(Jefferson)	40	390		41,511
Ripon Light & Water Co	404	179	126	35,804
Whitewatwr El.Lt.Co.	327	865	252	37,552
Mun.El.Lt.Plant(Richland Center)		522		35,735
Waupaca El.Lt. & Ry.Co.	239			34,050
Viroqua El.LT.Co.	215	269		27,685
Darlington El. & W.Pr.Co.	163	293		17,222
Rhinelander Lt.Co.	800	200	400	29,753
Mun.W.&Lt.Plant(Bayfield)	151	56	50	27,418
United Ht.& Pr.Co.(Delavan)	236	396		25,338
No.Milw.Lt.& Pr.Co.	26	640		24,080
Dodgeville El.Lt.& Pr.Co.		77		20,432
Tomah Elec. & Tel Co.		4,346		19,140
Twin City El.Co.(Hurley)	275	11		17,584
Mellen Lt. & W.Co.	64	357	199	20,150
Duck Creek Light & Pr.Co.	41	50		17,559
Bloomer El.Lt.Plant		165		15,338
Menominee Fall El.Co.	20	45		11,215

The values given in this table were obtained from the detailed inventories made by the Commission's Engineers and follows the inventory classification previously given on page 4. Only those parts of the valuations due to light and power business are given; wherever a company supplies power for railway work the percentage investment due to this phase of the business has been deducted. The 12% added for engineering and superintendence is not included in the values given. Leaving the Milwaukee plant out of consideration on account of its enormous size compared to the others we find that the total investment varies from $466,141 for the La Crosse City Gas and Electric Company as a maximum down to $11,215 for the Menominee Falls Electric Company as a minimum. About twenty four per cent of the plants are above $100,000 total investment, about thirty four percent below $30,000 and the remaining forty two percent between these limits.

The following table shows the percent distribution of investment by groups.

TABLE 6
DISTRIBUTION OF INVRSTMENT
BY GROUPS.

Company	Percentage Distribution of Investment for Land	Dist. System.	Power Plant Equip	Bldgs. Misc. Str's.	Office Furn. Sup's.	Tools Imp's. Mach.	Horses Wagons & Misc.
The Milwaukee El.Ry.&Lt.Co.	6.4	51.6	27.8	11.9			
Madison Gas & El.Co.	3.2	32.6	50.4	11.[illegible]	.53	.43	.27
La Crosse City Gas &El.Co.	2.5	52.4	36.3	7.8	.32	.60	.06
Superior W.Lt. & Pr.Co.	1.2	56.1	29.[illegible]	10.4	.40	1.94	
Wis. Tr.Lt Ht. & Pr.Co.	4.1	45.7	33.2	16,.5	.30	.15	.08
Sheboygan Ry.& Lt.Co.	.27	56.5	29.9	12.5		.53	
Beloit E. Gas & El.Co.	3.94	41.2	36.6	16.9	.55	.82	.08
Wausau St.Ry Co.	1.68	49.8	31.3	16.4	.58		
Eastern Wis. Ry.& Lt. Co.	.91	51.0	40.8	6.6	.52	.13	
Kenosha Gas & El.Co.	11.2	42.0	39.2	5.69	1.3	.55	.23
Manitowoc El.Lt.Co.	4.68	52.4	37.5	4.9		.50	
Menominee&Marinette Tr.Co.	2.54	48.5	38.9	10.42	.25	.38	
Chip.Falls W.W & Lt.Co.	.40	46.3	39.9	'.90	1.18	2.70	.63
Ashland Lt.Pr.& St.Ry.Co.	.62	60.0	33.8	5.00	.38	.46	.05
Berlin Light & Pr.Co.	2.53	53.3	50.1	6.83	.60	.20	.46
Red Cedar Valley El.Co.	12.3	17.1	27.7	41.9	.35	.70	
Burkhardt Mfg.El.& Pr.Co.	11.9	27.5	28.1	32.2	.06	.16	
Equitable El.& Lt.Co.		57.7	37.6		1.87	2.07	.81
Mineral Point El.Lt.Co.	.65	40.3	43.8	12.7	.27	.51	1.72
O.I.Newton Son's Co.	8.68	50.3	21.1	17.9	.81	.78	

TABLE 6 (Continued)
DISTRIBUTION OF INVESTMENT BY GROUPS.

Company	Percentage Distribution of Investment for: Land	Dist. System	Power Plant Equip	Bldgs Misc. Str's	Office Furn. Sup's.	Tools Imp's. Mach.	Horses Wagons & Misc.
Monroe El.Lt.& Pr.Co.	7.28	42.5	36.4	13.1	.19	.60	
Kaukauna Gas El.Lt.& Pr.Co.		48.2	30.0	20.1	1.08	.66	
De Pere Light & Pr.Co.	not included	50.2	27.4	19.3	1.63	1.05	
Antigo El Lt.Co.	4.03	58.6	29.8	4.72	.86	1.39	.34
Mun.W.& Lt.Dept.(Jefferson)	12.8	30.3	28.3	27.6	.09	.94	
Ripon Lt.& W.Co.	2.66	39.6	35.7	17.5	1.10	.49	.34
Whitewater El.Lt Co.	leased-----	41.3	44.9	9.95	.90	2.36	.67
Mun.El.Lt.Plant(Rich.Ctr.)	2.1	46.3	36.1	13.9		1.46	
Waupaca El.Lt.& Ry.Co.	11.6	48.2	53.6	13.46	.99		
Viroqua El.Lt Co.	3.26	37.7	38.4	18.7	.78	.94	
Darlington El.&W Pr.Co.		48.3	56.2		.95	1.70	
Rhinelander Light Co.	1.68	74.6	8.9	10.1	1.69	.62	1.35
Mun.W.& Lt.Plant(Bayfield)	2.58	42.5	40.0	13.9	.55	.21	.18
United Ht.Lt.& Pr.Co.	1.97	44.8	41.1	9.7	.93	1.56	
No.Milw.Lt&Pr.Co.	12.18	38.6	39.2	7.4	.11	2.66	
Dodgeville El.lT.& pr.Co.	1.47	31.8	54.5	12.7		.38	
Mellen Light & W.Co.	8.65	26.3	16.7	45.6	.32	1.68	1.00
Tomah El. & Tel Co.	.21	47.4	16.3	13.0		22.70	
Twin City El.Co.(Hurley)	.2	52.5	42.5	14.0	1.75	.07	
Duck Creek Lt.& Pr.Co.	28.5	18.3	30.0	22.4	.23	.28	
Bloomer El.Lt.Plant.	4.90	39.0	21.1	34.0		1.08	
Menominee Fall El.Co.	5.8	18,9	62.5	12.3	.18	.40	

TABLE 6 (Continued)
DISTRIBUTION OF INVESTMENT BY GROUPS

Company	Percentage Distribution of Investment for Land	Dist System	Power Plant Equip	Bldgs Misc. Str's.	Office Furn Sup's.	Tools Imp's. Mach.	Horses Wagons &Misc.
Mimimum	.20	17.1	8.91	4.72	.06	.07	.05
Maximum	28.5	74.6	62.5	45.6	2.69	22.70	1.72
Average	4.87	44.20	35.8	15.25	.731	1.46	.517
Median	3.20	46.3	36.35	12.70	.53	.62	.34

In Table 6 it will be observed that the percenta ge distribution for land and also buildings and miscellaneous structures varies greatly while that of the distribution system and power plant equipment is fairly constant. The maximum investment in land is 28.5% that of the Duck Creek Light and Power Company and the minimum is but .20% that of the Twin City Electric Company. The first company has an hydraulic and gas plant and thus has a large investment in pondage rights while the second company is in the northern part of the state where land is cheaper.By comparing Table No.6 and No.3 it will be found in most cases that the companies having a large land investment are either hydraulic or are located in populous districts.

The maximum distribution investment, 74.6%, is that of Rhinelander. This is due to the fact that the Rhinelander Light Company purchases its power and consequently has a small power plant investment. This would make the total investment rather low hence the percentage investment in distributiom would be high. Menominee Falls has a maximum power plant equipment of 62.5% which arises from the duplicate equipment at this plant. The apparatus is in poor condition and is operating at low effiency. If either equipment were running at a good efficiency and were re-

liable the other would be dispensed with as an unnecessary expense. The values obtained for power plant equipment and buildings and miscellaneous structure do not vary much, the average for power plant equipment being 38.8% and the median 36.35% while the average for buildings and miscellaneous structures is 15.25% and the median 12.70%. The other items show the naturally small percentage investment in office furniture, tools, implements, horses and wagons.

TABLE 7
LAND INVESTMENT PER UNIT.

Name of Company	Investment per unit in Land Dollars. Per Conc.	Per K.W. Sta. Cap.	Per K.W. Conn. Load	Per K.W. Max. Dem.	Per K.W. Out-Put	Per 1000 Pop.
The Milwaukee ELRy.& Lt.Co.	31.2	16.1	9.87	22.5	.0051	635
Madison Gas & Elec.Co.	3.53	4.48	3.03	7.2	.0030	563
La Crosse City Gas & El.Co.	3.77	4.84	2.06	6.8	.0028	380
Superior Lt.& Pr.Co.	1.43	3.43	1.14	4.33	.0025	103
Wis.Tr.Lt Ht.& Pr.Co.	7.75	10.96	4.19	13.70	.0062	384
Sheboygan Ry.& Lt.Co.	.32	3.34	.27	.47	.00014	18.95
Beloit W. Gas & El.Co.	8.94	7.82	4.57	10.04	.0050	465
Wausau St.Ry.Co.	2.18	1.65	1.24		.00089	254
Eastern Wis. Ry. &Lt.Co.	.82	.87	.71	1.35	.0005	51
Kenosha Gas & Elec Co.	20.42	24.05	14.94	40.4	.0155	564
Manitowoc El.Lt.Co.	3.68	10.00	3.62	12.1	.006	345
Menominee &Marinette Lt Co.	4.10	3.41	1.87		.0027	216
Chip.Falls W.Wks & Lt.Co.	.79	.56	.51	1.01		34.2
Ashland Lt.Pr.&Ry.Co.	.76	.79	10.76	1.32		42.65
Berlin Light & Power Co.	5.62	3.09	2.38	3.55		387
Red Cedar Valley El.Co.	13.00	18.00	17.15	55.80	025C	2,040
Burkhardt Mfg.& El. Pr.Co.	16.42	29.90	21.30	36.80	.0145	2,860
Equitable El.Lt Co.						
Mineral Poimt El. Lt. Co.	.94	.50		1.82		57.2
O.I.Newton Son's Co.	7.90	7.72	3.30	8,10		655

TABLE 7(Continued)
LAND INVESTMENT PER UNIT

Name of Company	Investment per Unit in Land Dollars Per Cons.	Per K.W. Sta. Cap.	Pwe K.W. Conn. Load	Pwr K.W. Max. Dem.	Per K.W. Out-Put	Per 1000 Pop.
Monroe El.Lt.& Pr.Co.	7.93	16.00	8.03	16.12	.0145	907
Kaukauna Gas EL.Lt& Pr.Co.						
De Pere Lt.& Pr. Co.						
Antigo El.Lt.Co.	1,97	4.00	3.88	6.78	.00345	278
Mun.W.& Lt.Co. (Jefferson)	21.48	35.5.	130.00	88.9	.0545	2,060
Ripon Light & Water Co.	4.35	5.5	4.05	8.48	.00872	261
Whitewater El.Co	Leased					
Mun. El.Light Plant	2.11	3.0C	16.65			283
Waupaca El.Lt & Ry Co.	12.4	12.1			.0183	1,410
Viroqua El.Lt.Co.	3.42	10.00		12.05	.oo925	437
Darlington El.& W.Pr.Co.						
Rhinelander Light Co.	.99		1.31			88.7
Mun.W. & Light Plant(Bayfield)	3.35	3.53	3.21	7.06.	.00497	262
United Lt.Ht. & Pr.Co.	1.61	3.12	1.82	4.77	.00523	204
No.Mil.Lt& Pr.Co.	27.40	19.80	17.10	29.35	.0104	1,575
Dodgeville El.Lt.& Pr. Co.	3.00	3.53	1.75	3.00	.	167.5
Mellen Lt. & Water Co.	12.50	29.00	34.00		.0218	950
Tomah El.& Tel.Co.	.20	1.91				11.7
Twin City El.Co.(Hurley	.39	.09				2.13
Duck Creek Light & Pr.Co.	86.2	83.3	125.	100.		4,430
Bloomer El.Lt.Plant	7.15	16.65	15.	2.43		622
Menominee Fall El.Co.	7.93	10.83				707
Minimum	.32	.09	.27	.47	.00014	2.13
Maximum	86.2	83.3	130.	125.	.0545	4,430
Average	9.14	11.35	15.05	19.10	.01084	680
Median	3.77	5.17	3.21	7.13	.00516	287

It was noted in connection with Table No. 6 that the per cent investment in land varied to such an extent on account of local conditions that no relation between the size of the plant and the amount invested in land could be determined. For this reason Table #7 shows a correspondingly wide variation of investment per unit in land. There seems to be no chance of predetermining what the land investment per K.W. station capacity or per 1000 population for instance should be. We find a variation of from 0.32 to 86.0 dollars invested in land per consumer; from 0.09 to 83. dollars per K.W. station capacity;and from 2.13 to 4430.0 dollars per 1000 population supplied. The average and median values obtained from this Table mean very little. Its only value as a table is for finding the distribution of land investment for any particular plant.

TABLE 8.
DISTRIBUTION OF SYSTEM PER UNIT.

Name of Company	Per Cons.	Investment per unit in Distribution System. Per KW. Sta. Cap.	Per KW Conn. Load	Per KW Out-put	Per KW Max. Demand	Per 1000 Pop.
Milwaukee El.Ry.& Lt.Co.	251.	129.5	79.6	.0412	190.0	5110
Madison Gas & El.Co.	35.5	45.2	30.5	.0320	72.5	5670
La Crosse City Gas & El.Co.	79.5	102.0	43.4	.0591	144.0	8050
Superior W.Lt.& Pr.Co.	66.8	160.5	55.3	.1192	203.0	4770
Wis.Tr.Lt.Ht.& Pr.Co.	86.5	122.4	46.2	.0692	153	4280
Shenoygan Ry.& Lt.Co.	67.2	69. 7	47.4	.0307	98.6	3960
Beloit W.Gas & El.Co.	93.3	81.5	47.6	.0517	105.0	4850
Wausau St.Ry.Co.	64.6	49.0	31.2	.0263		7240
Eastern Wis.Ry.& Lt.Co.	45.2	48.3	39.4	.0500	41.1	2830
Kenosha Gas & El.Co.	76.8	90.3	56.0	.0582	114.	2110
Manitowoc El.Lt.Co.	41.2	112.0	40.5	.0655	135.2	3860
Menoninee &Marinette Co.	58.8	65.0	35.4	.0522		4110
Chippewa Falls W.Wks.Lt Co.	81.1	65.0	58.7	.0350	116.9	3950
Ashland Lt.Pr.& St.Ry.Co.	73.5	199.5				4145
Berlin Lt.& Pr.Co.	118.3	75.2	50.2		74.9	8150
Red Cedar Valley El.Co.	18,1	35.2	23.9	.0354	77.8	2840
Burkhardt Mfg.& El.Co.	37.2	68.9	49.0	.0333	84.2	6600
Equitable El.Lt.Co.	50.2	82.0	39.1	.0860	194.5	8725
Mineral Point El.Lt Co.	58.2	31.0			112.8	3540
O.I.Newton Son's Co.	45.8	44.8	19.15		47.0	3800
Monroe El.Lt.& Pr.Co.	46.2	93.2	46.80	.0849	94.0	5290
Kaukauna El.Lt.& Pr.Co.	52.2	80.3	32.0		95.0	5620
De Pere Lt.& Pr.Co.	55.0	91.5	26.9	.0934	162.0	6350

TABLE 8
DISTRIBUTION OF SYSTEM PER UNIT.

Name of Company	Investment per unit in Distribution System: Per Cons.	per KW Sta. Cap.	Per KW Conn. Load	Per KW Out-put	Per KW Max. Demand	Per 1000 Pop.
Antigo El.Lt. Co	28.8	58.2	56.5	.0502	98.7	4050
Mun.W.& Lt.Co.(Jefferson)	50.6	83.9	306.0	.1285	210.0	4870
Ripon Lt.& W.Co.	64.8	82.2	60.5	.1295	126.	3880
Mun.El.Lt.Plant(Rich.Ctr.)	46.7	66.3	368.0	.1025		6250
Waupaca El.Lt.& Ry.Co.	36.6	35.6		.L540	14.05	4160
Viroqua El.Lt.Plant	39.8	116.2		.1073	140.5	5070
Whitewater El.Lt.Co.	40.0	51.7	37.1	.1270	143.0	4820
Darlington El.& Lt.Pr.Co.		66.5	69.5		78.3	4600
Rhinelander Light Co.	35.9		224.5			3940
Mun.W.& Lt.Plant	55.3	58.4	53.1	.0822	116.8	4340
United Ht.Lt.& Pr.Co.	36.5	70.80	41.2	.1188	107.8	4620
No.Milw.Lt. & Pr.Co.	86.9	62.7	54.3	.0330	92.9	5000
Dodgeville El.Lt.& Pr.Co.	65.0	76.6	108.3	.1130	144.2	3630
Mellen Lt.& W.Co.	38.1	88.3	105.9#	.0661		2890
Tomah El.Tel.Co.	45.2	43.1				2650
Twin City El.Co.	28.5	24.9				554
Duck Creek Lt.& Pr.Co.	55.5	50.2	80.4		64.3	2850
Bloomer El.Lt. Plant.	57.0	132.8	119.6			4970
Menominee Falls El.Co.	24.5	33.5				2190
Maximum	251.0	199.5	368.0	.1295	210.0	8725
Minimum	18.1	24.9	19.2	.0263	41.1	554
Average	59.7	86.5	80.7	.0704	110.	4480
Median	50.6	68.9	50.2	.0591	106.4	4310

Estimated (#)

The variation of investment per unit in distribution system for the various plants is much less than for any other division of total investment. The reason for such uniformity lies in the fact that in most cases the area covered by the distribution system bears a very close relation to the size of plant and also to the population of the cities supplied, so that even tho the type of system used differs with undivided plants, the investment required per unit is very uniform. Red Cedar Valley El. Co. has the lowest investment per consumer on account of the fact that the local distribution system is the one used by the old Municipal plant and part of them is still owned by them although used by the present company. The Milwaukee El.Ry. & Lt. Co. has the maximum investment per consumer. This company has a very large distribution system to supply the lighting of Milwaukee and surrounding suburbs. The consumers supplied in the city are not in proportion to the size of the the plant however, there being some small companies supplying limited areas in the down town district. Both of these facts tend to make the investment per consumer very high. It is hardly fair to make a comparison along any line between a company of this size and the other plants in the state.

The maximum investment per K.W. station capacity obtains in the case of the Ashland Lt. Pr.7 St. Ry.Co. They operate several small plants so that the proportion between capacity and area covered by the distribution system of these plants tends to make the investment per K.W. capacity high. The average and medians for this table agree very closely so that these figures may be taken as representative in average cases.

TABLE 9.
POWER PLANT EQUIPMENT INVESTMENT PER UNIT.

Name of Company	Investment Per Unit in Power Plant Equipment. Per Cons.	Per KW Sta. Cap.	Per KW Conn. Load	Per KW Max. Demand	Per KW Out-put	Per 1000 Pop.
Milw.El.Ry. & Lt. Co.	135.5	70.0	42.9	102.4	.0223	2760
Madison Gas & El.Co.	55.0	70.0	47.2	112.0	.0467	8770
La Crosse City Gas & El.Co.	55.1	70.7	30.1	99.5	.0409	5570
Superior W Lt.& Pr.Co.	35.6	85.4	28.4	108.0	.0635	2540
Wis.Tr. Lt. Ht. & Pr. Co.	62.2	88.8	33.3	110.0	.0498	3090
Sheboygan Ry.& Lt.Co.	35.4	36.7	27.4	52.0	.0162	2085
Beloit W.Gas & El.Co.	83.3	72.7	42.5	93.5	.0462	4320
Wausau St.Ry. Co.	41.0	31.0	19.7		.0167	4600
Eastern Wis. Ry.& Lt.Co.	36.2	38.8	31.5	60.0	.0219	2265
Kenosha Gas & El. Co.	71.6	84.5	52.5	106.8	.0545	1950
Manitowoc El.Lt.Co.	29.5	80.3	29.0	97.0	.0470	2770
Menominee & Marinette Co.	47.3	52.2	28.6		.0420	3310
Chip. Falls W.Wks.Co.	77.5	56.0	50.7	107.9	.030 2	3400
Ashland Lt.Pr. & St.Ry.Co.	41.4	112.0				2320
Berlin Lt.& Pr.Co.	11.0	61.2	47.1	70.1		7650
Red Cedar Valley El.Co.	29.3	57.0	38.7	126.0	.0575	4600
Burkhardt Mfg. & El.Co.	38.7	70.4	49.8	86.0	.0340	6640
Equitable El.Lt. Co.	32.6	53.4	25.5	127.0	.0576	5670
Mineral Point El.Lt.Co.	60.4	33.7		123.6		3860
C.I.Newton Son's Co.	19.2	18.7	8.01	19.7		1590
Monroe El.Lt.& Pr.Co.	39.6	80.0	40.1	80.6	.0727	4530
Kaukauna Gas El.Lt Co.	32.5	50.0	19.9	59.2		3500
De Pere Light & Pr. Co.	30.5	50.8	14.9	90.0	.0518	3520

TABLE 9(Continued)

Name of Company	Investment Per Unit in Power Plant Equipment: Per Cons.	Per KW Sta. Cap.	Per KW Conn. Load	Per KW Max. Demand	Per KW Out-put	Per 1000 Pop.
Antigo El.Lt.Co.	14.7	29.8	28.9	50.5	.0257	2070
Mun.W.& Lt.Dept.	47.4	78.4	282.0	196.0	.1200	4550
Ripon Lt.& Water Co.	58.7	74.4	54.6	114.0	.1172	3520
Whitewater El.Co	43.4	56.2	40.2	154.5	.1380	5220
Mun.El.Lt.Plant	36.5	51.8	281.0		.0805	4880
Waupaca El.Lt.Co.	40.6	39.6			.598	4620
Viroqua El.Lt.Co.	40.5	118.4		143.0	.1095	5170
Darlinton El.& Water Co.	40.4	77.3	49.3	91.1		5350
Rhinelander Light Co.	5.2		27.0			470
Mun.W.& Lt.Plant	51.9	54.8	49.8	109.6	.0771	4070
United Ht.Lt.& Pr.Co.	34.8	65.0	37.9	99.2	.1090	4250
No.Milw.Lt.& Pr.Co.	88.1	63.7	55.1	94.3	.0335	5070
Dodgeville El.Lt.&Pr.Co.	109.5	129.0	182.5	293.0	.1905	6110
Mellen Lt. & W.Co.	24.1	56.0	67.2#		.0420	1835
Tomah El.& Tel Co.	16.0	15.3				940
Twin City El.Co.	23.1	20.2				448
Duck Creek Lt.& Pr.CO.	91.7	88.5	132.7	106		4700
Bloomer El.Lt.Plant	30.7	71.7	64.7			2,690
Menoninee Falls El.Co.	25.8	35.3				2300
Maximum	135.5	129.0	282.0	243.0	.1905	7650
Minimum	5.2	15.3	8.0	10.5	.0162	490
Average	48.3	62.2	58.5	100.5	.0603	3750
Median	40.4	61.2	38.7	99.5	.0518	3090

(#)Estimated

The investment per unit in power plant equipment as shown in the preceeding table is fairly uniform for the various plants. Per consumer this investment averages 47.3 dollars with the median 40.4. The Milwaukee El.Ry.& Lt. Co. has a maximun investment of 135 dollars per consumer due perhaps to the fact that a great many of their consumers are users of very large amounts of power for industrial purposes. One would expect the investment in power plant equipment per K.W. capacity to be practically the same for plants of the same type and altho this investment varies from from 129 dollars to 15.3 dollars the average is 62.2 and the median 61.2 showing that the average figure is a representative one for the majority of cases. The investment per 1000 population shows a similarly close relation between the average and the median but the other columns of the table show a very considerable variance. Madison Gas & El. Co. has the largest investment in power plant equipment per 1000 population due no doubt to the fact that this Company has a great many suscribers in proportion to the population of the city and the conditions are such that the consumption of power per consumer is large.

TABLE 10
BUILDINGS INVESTMENT PER UNIT.

Name of Company	Investment per Unit in Buildings Misc.Structures. Per Consumer	Per KW Sta. Cap.	Per KW Conn. Load	Per KW Max. Demand	Per KW Output	Per 1000 Pop
Milw.El.Ry.& Lt.Co.	58.1	3o.00	18.40	44.0	.00956	1183
Madison Gas & El.Co.	12.5	15.85	10.70	25.4	.01050	1990
La Crosse City & El.Co.	12.5	15.10	6.45	21.3	.00905	1198
Superior W.Lt.&.Pr.	12.3	29.65	9.85	37.4	.0220	882
Wis. Tr.Lt.Ht.& Pr.Co.	31.2	44.3	16.7	55.3	.0250	1545
Sheboygan Ry.& Lt.Co.	14.8	15.4	10.4	21.6	.0067	876
Beloit W.Gas El.Co.	38.5	33.60	19.6	43.2	.0214	2000
Wausau St.Ry.Co.	21.4	16.1	10.3		.0087	2392
Eastern Wis. Ry.& Lt.Co.	5.94	6.35	5.17	9.85	.00358	371
Kenosha Gas & El.Co.	10.4	12.2	7.6	15.5	.0079	284
Manitowoc El.Co.	3,85	10.45	3.78	12.6	.00613	361
Menominee & Marinette Tr.Co.		14.00	7.64			890
Chip.Falls W.Wks & Lt.Co.	17.5	12,50	11.3	22.5	.00675	757
Ashland Lt.Pr.& St.Ry Co.			16.62			344
Berlin Lt.& Power Co.	15.2	8.36	6.43	9.6		1045
Red Cedar Valley El.Co.	44.3	86.40	58.6	190.5	.0868	6970
Burkhardt Mfg.& El.Pr.Co.	44.5	80.80	57.50	98.8	.0391	7740
Equitable El.Lt.Co.(Lake Geneva)						
Mineral Point El.Lt.Co.	18.30	9.75		35.4		1114
O.I.Newton Son's Co(Sparta)	16.3	15.90	6.80	16.7		1350
Monroe El.Lt & Pr.Co.	14.2	28.70	14.40	28.9	.00261	1630
Kaukauna Gas El.Lt. & Pr.Co.	21.8	33.50	13.38	39.7		2345

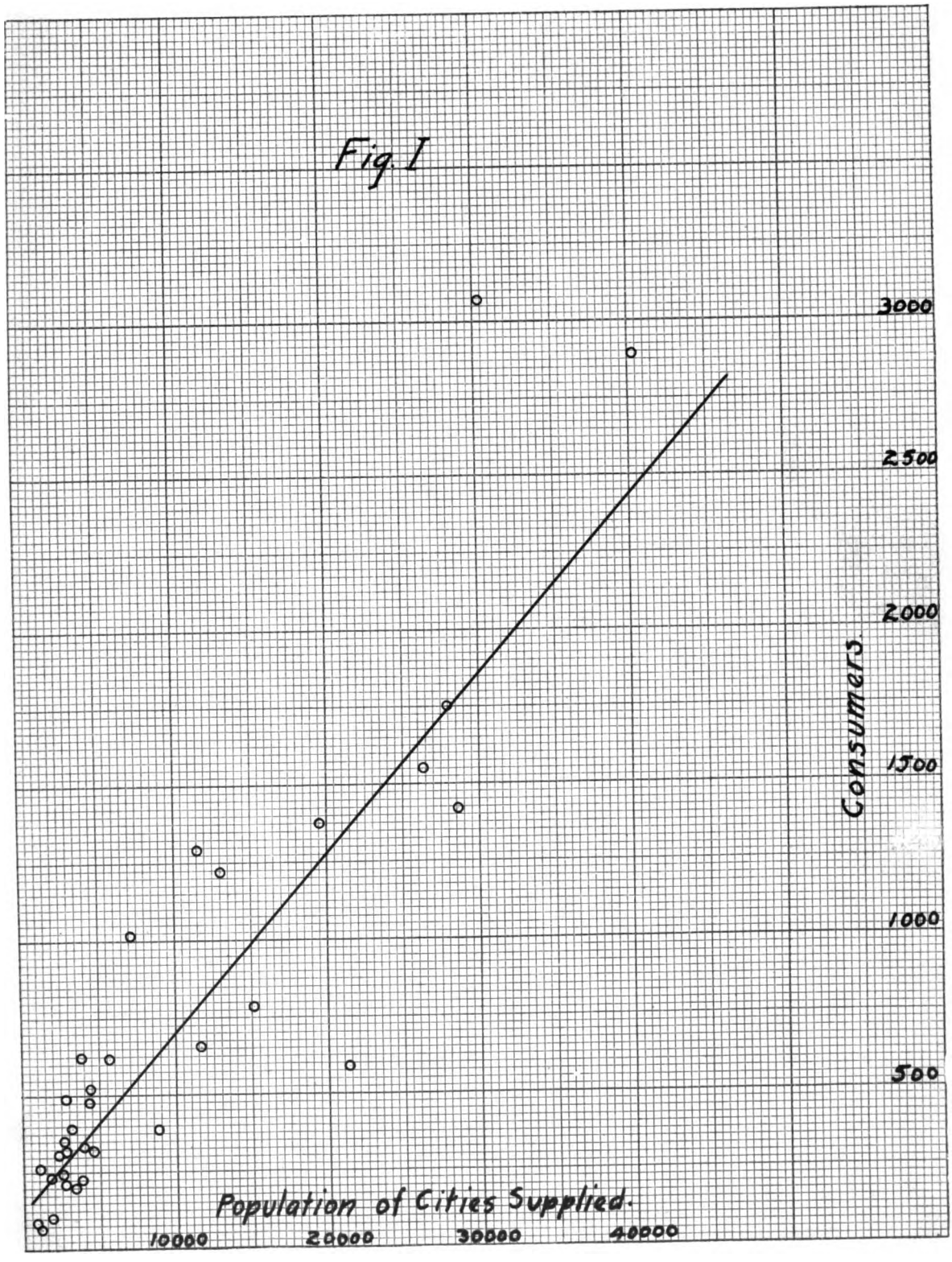
TABLE 10(Continued)
BUILDINGS INVESTMENT PER UNIT.

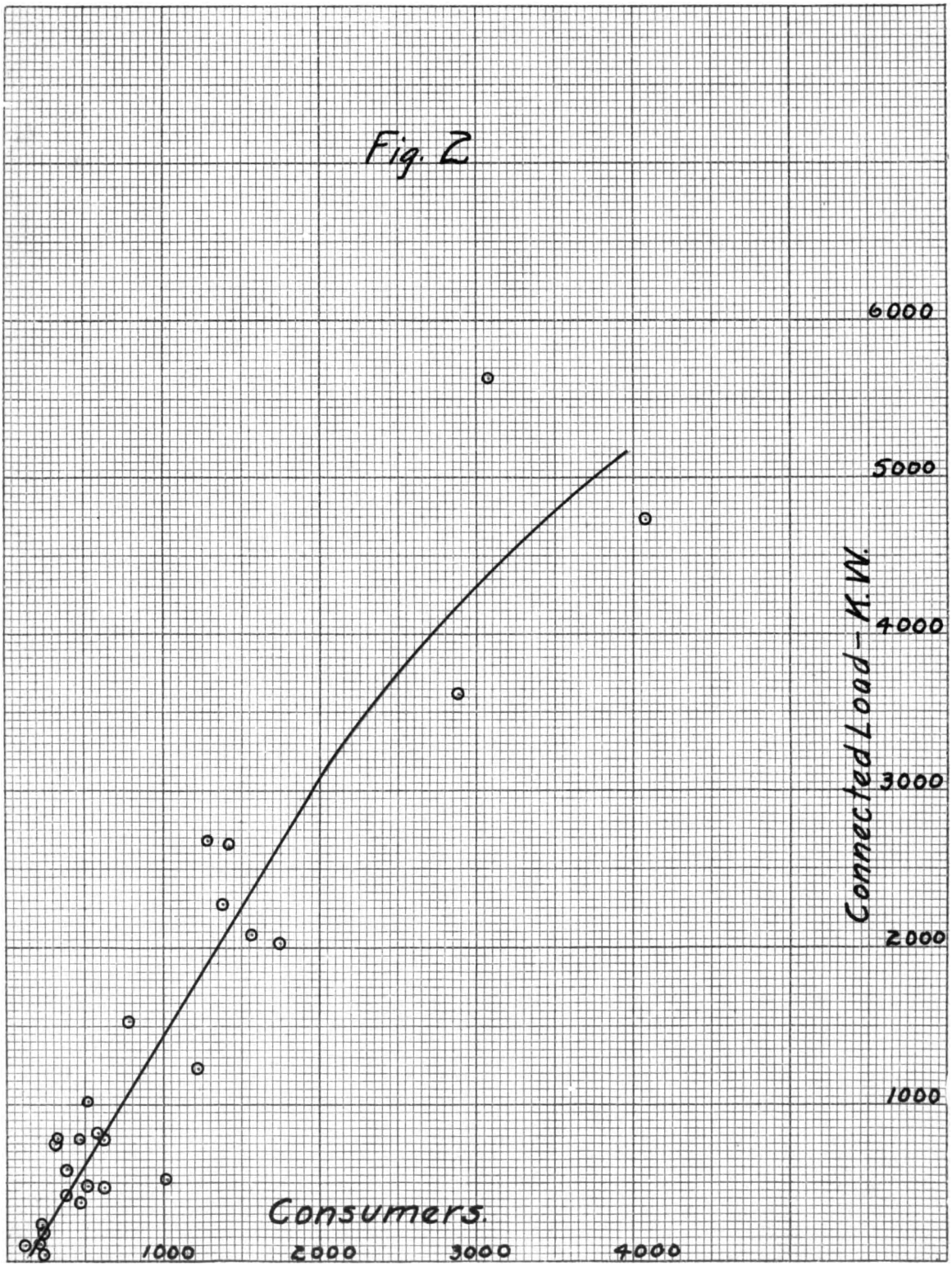
Name of Company	Investment per Unit in Buildings Misc.Structures. Per Consumer	Per KW Sta. Cap.	Per KW Conn. Load	Per KW Max. Demand	Per KW Output	Per 1000 Pop.
De Pere Lt.& Pr.Co.	21.0	35.00	10.20	62.0	.0357	2425
Antigo El.Lt.Co.	2.3	4.69	4.55	7.9	.0041	326
Mun. W. Lt. Dept.(Jefferson)	46.L	76.20	279.0	191.0	.1170	4425
Ripon Lt. & Water Co.	28.7	36.40	26.7	56.0	.057	1720
Whitewater El.Co.	9.6	12.40	8.9	34.3	.0305	1156
Mun.Elec.Lt.Plant	14.0	19.85	110.5		.0309	1875
Waupaca El.Lt.& Ry.Co.	14.45	14,1			.0213	1640
Viroqua El.Co.	19.60	57.5		69.4	.0530	2510
Darlington El.Co.						
Rhinelander Light Co.	5.92		3.05			533
Mun. W.Lt.Plant (Bayfield)	18.10	19.08	17.35	38.17	.0269	1420
United Ht.Lt.& Pr.Co.(Delavan)	7.91	15.3	8.92	23.4	.0257	1000
No.Milw.Lt.& Pr.Co.	16.40	11.84	10.25	17.5	.0062	942
Dodgeville El.Lt.& Pr.Co.	24.52	30.60	43.30	57.8	.0452	1450
Mellen Lt.& W.Co.	65.8	153.00	183.20			5000
Tomah El.& Tel.Co.	12.44	11.85				728
Twin City El.Co.(Hurley)	7.57	6.62				1475
Duck Creek Lt.& Pr.Co.	68.0	65.6	98.5	78.8		3490
Bloomer El.Lt.Plant	49.7	115.8	104.2	16.9		4330
Menominee Fall El.Co.	16.8	22.9				1496
Minimum	2.30	4.09	3.78	5.40	.00261	326
Maximum	68.00	153.0	279.00	191.00	.11700	7740
Average	22.60	32.3	36.6	45.8	.0266	1866
Median	17.15	17.59	12.34	34.85	.0213	1435

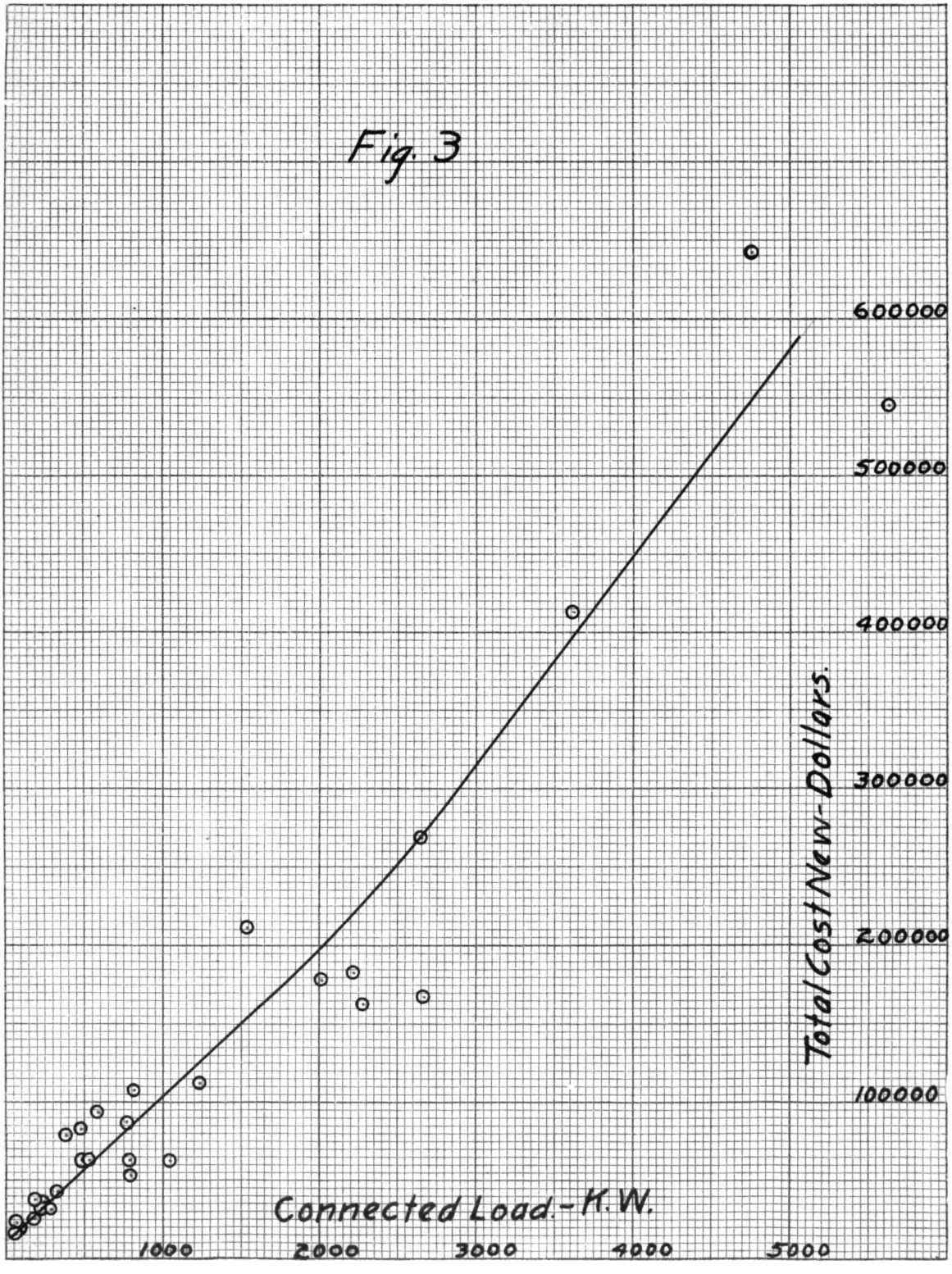
Table 10 giving the investment per unit in buildings and miscellaneous structures is unimportant in comparison with the investment per unit in land, transmission system and power plant equipment. The Duck Creek Light and Power Co. has the maximum investment of $68.00per consumer in buildings Table No.6 shows that Duck Creek has an investment of 22.4% in buildings while the average is 15.25%. Also Table No.4 shows that the Duck Creek has the minimum number of consumers, hence the reason for the maximum unit investment. The Mellen Light & Water Co. has a maximum investment per K.W.station capacity due to its small station capacity of 60 K.W. and its buildings investment of 45.6%. In general it will be found that the smaller stations have the higher investment per unit in buildings, and the reasons for this can be obtained from a consideration of the previous tables. The averages and medians of Table No.10 do not lie very close together consequently one could not expect to obtain any very definite data regarding the investment in buildings.

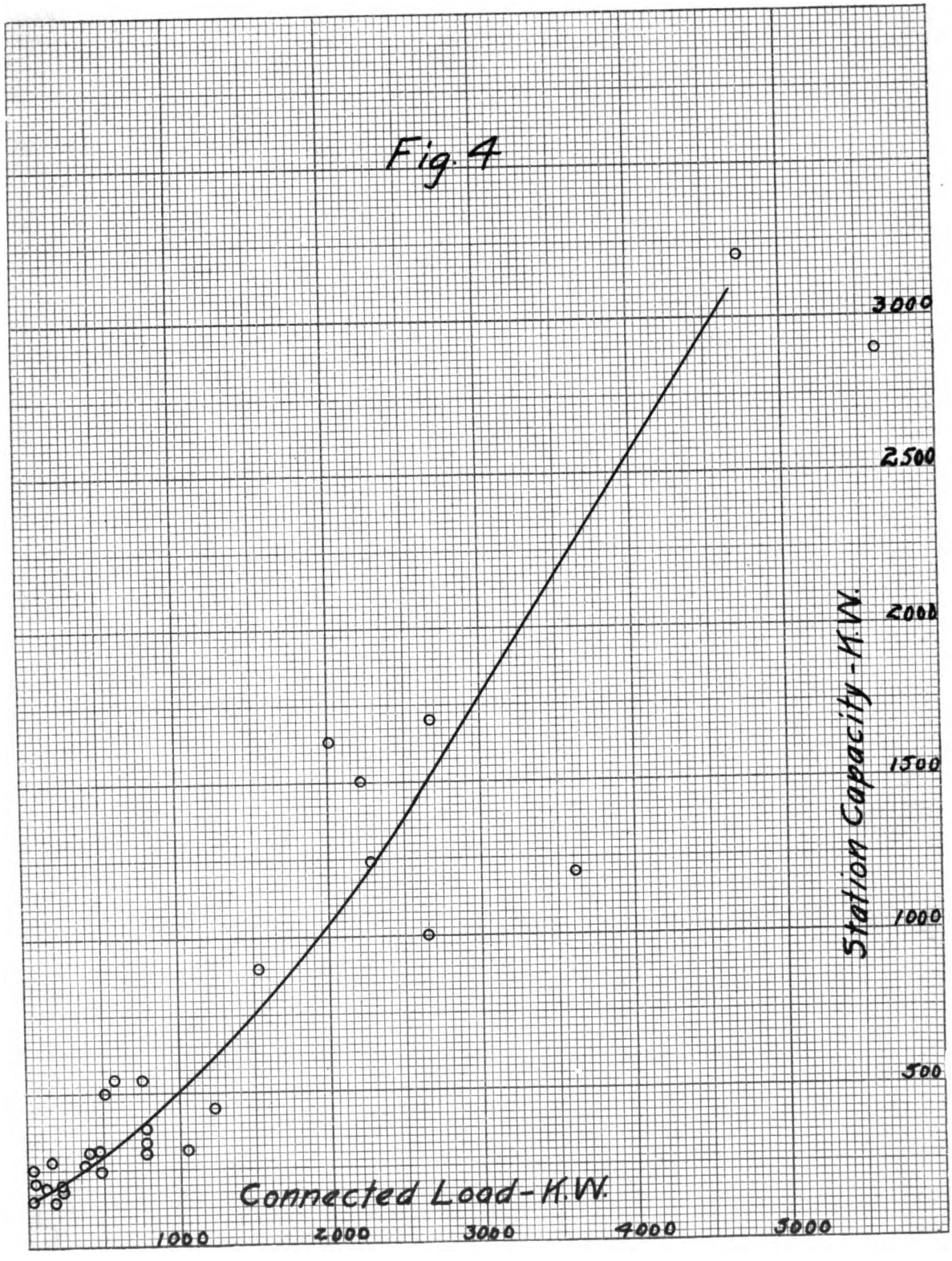
The following curves were obtained from the data given in Tables I to 5 inclusive in an attempt to determine whether or not any general relations could be established between the various costs and other character-

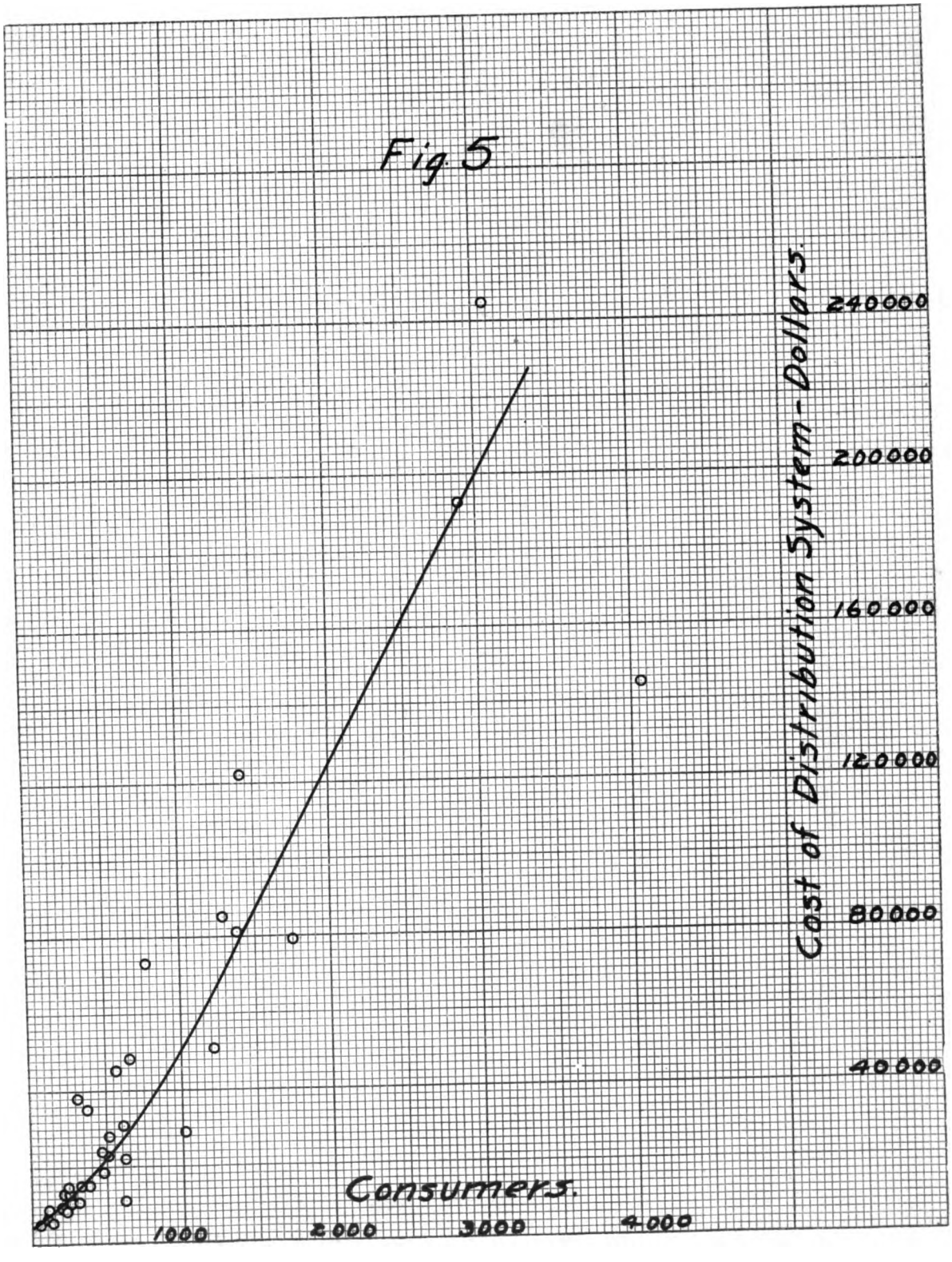
istics of the plants. As will be seen the variation from any definite relationship is very marked in every case due tothe effect of local conditions for each plant. In order to determine any satisfactory curves showing these relationships, local conditions for each plant would have to be analysed and allowances made. No attempt has been made to do this for these plants. The curves obtained however may very well be considered as representing average conditions.How nearly these average conditions may be relied upon can be seen from the general distribution of the points representing the plants.The figures present nothing more than is given in the table and are merely inserted so that any one familiar with the use of such curves can tell at a glance the approximate conditions which should obtain in the average case.

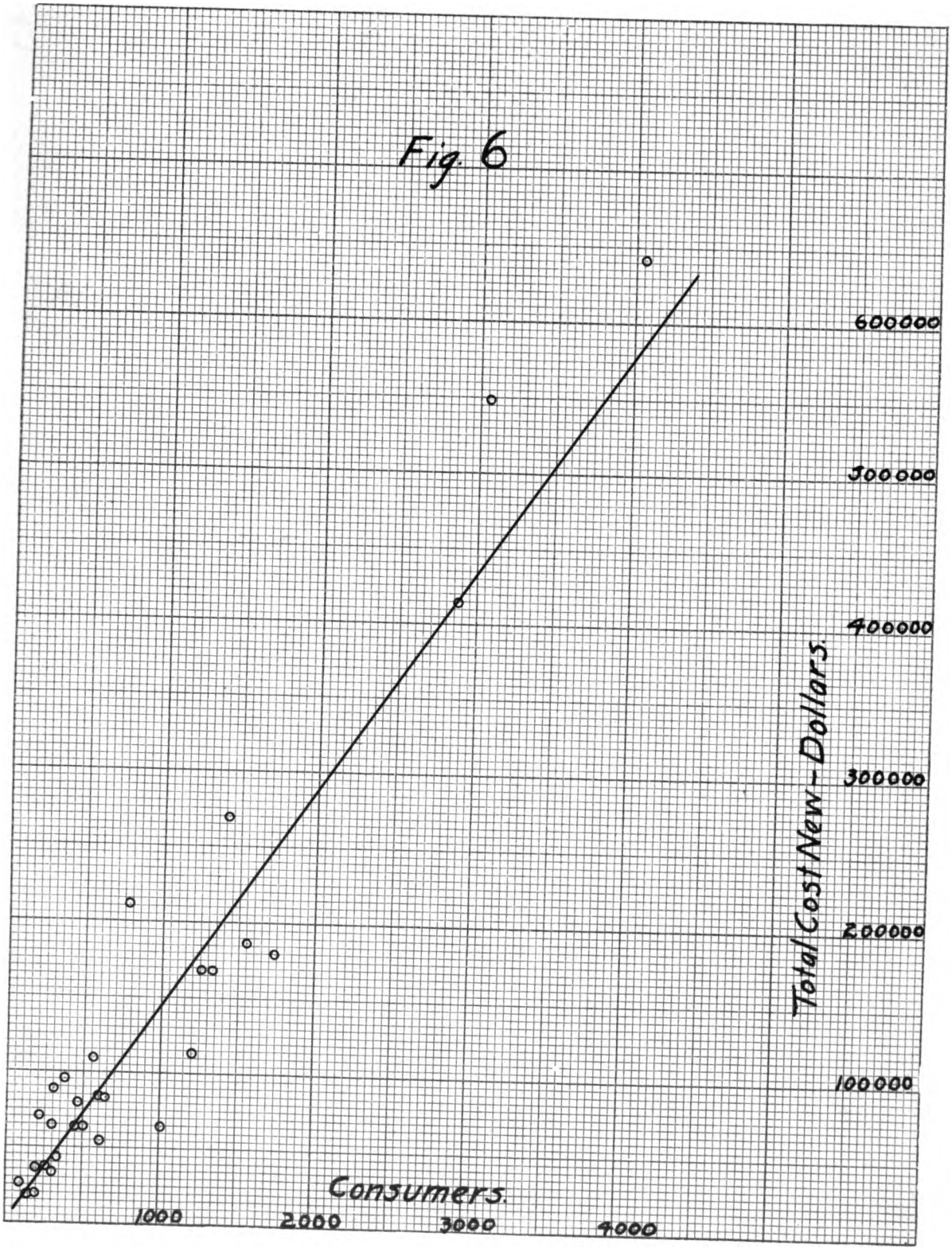


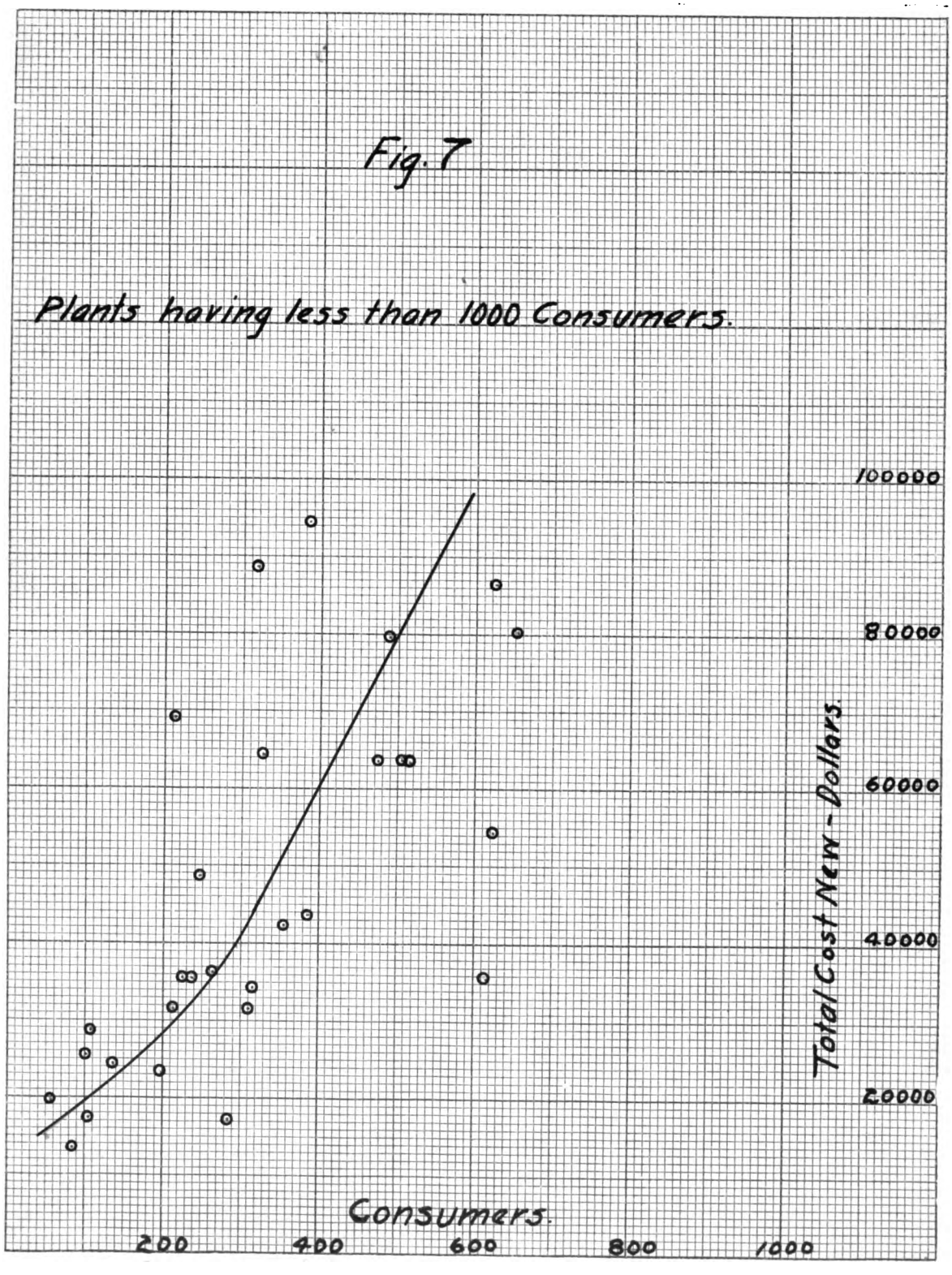


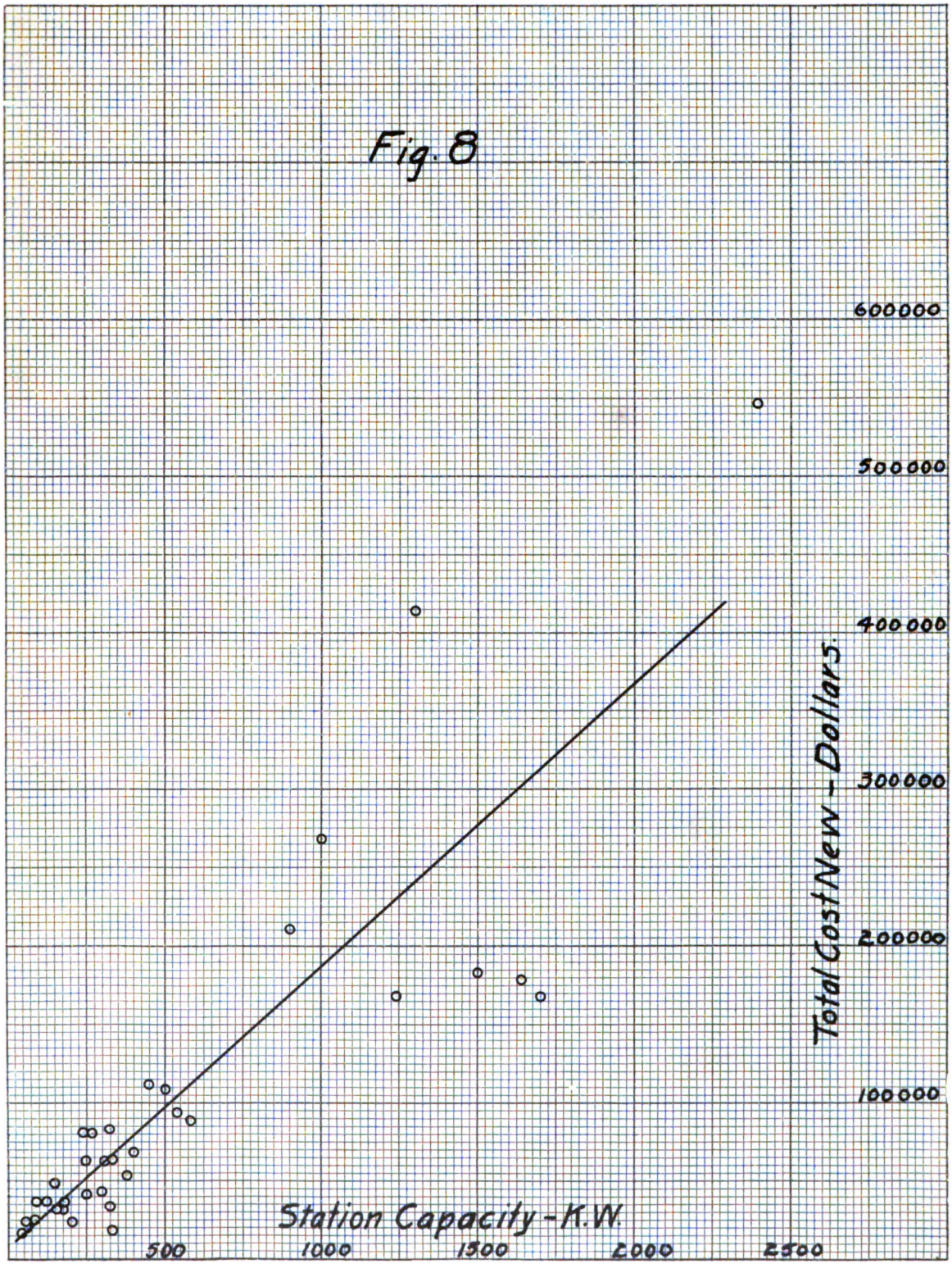


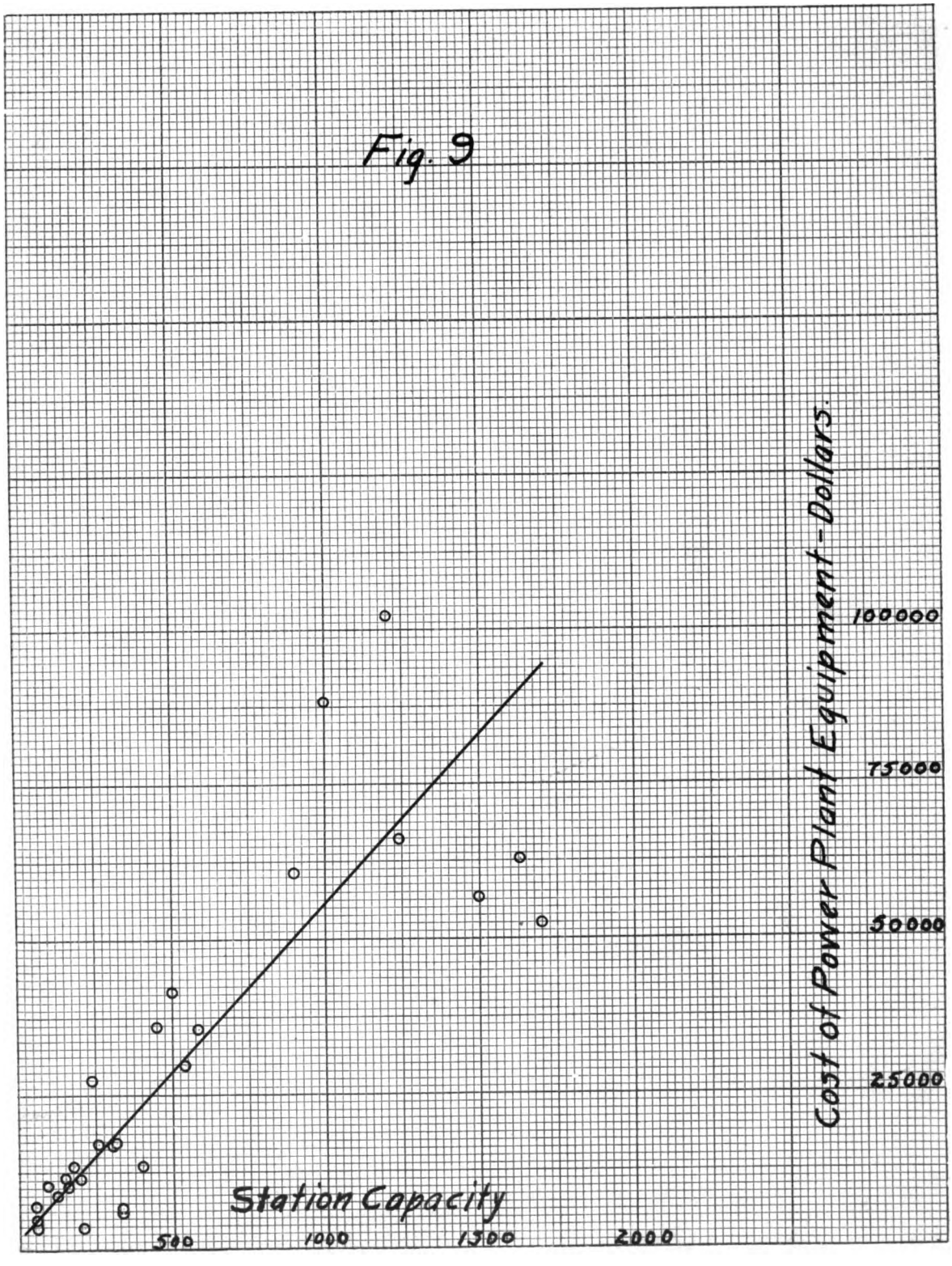


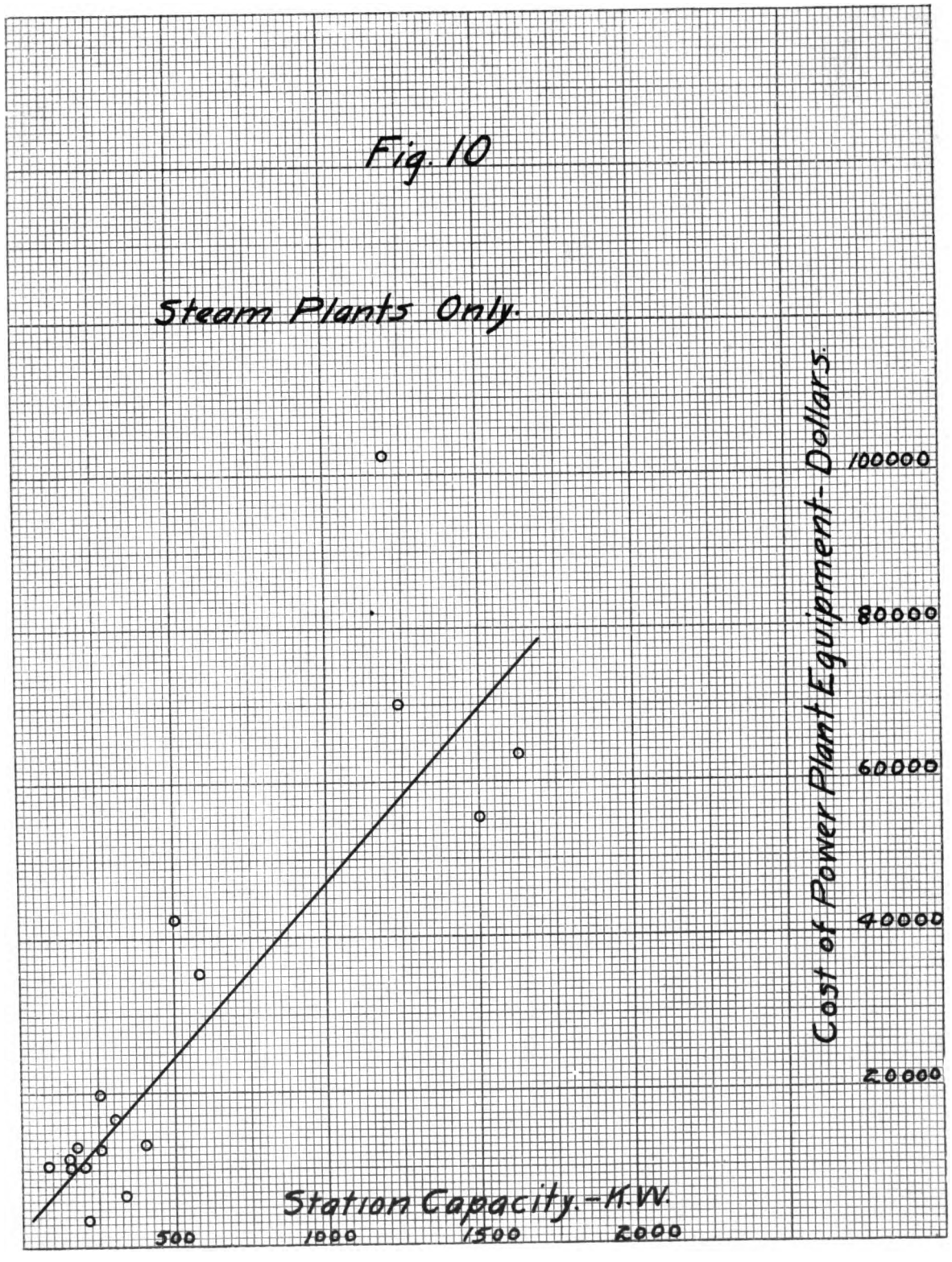


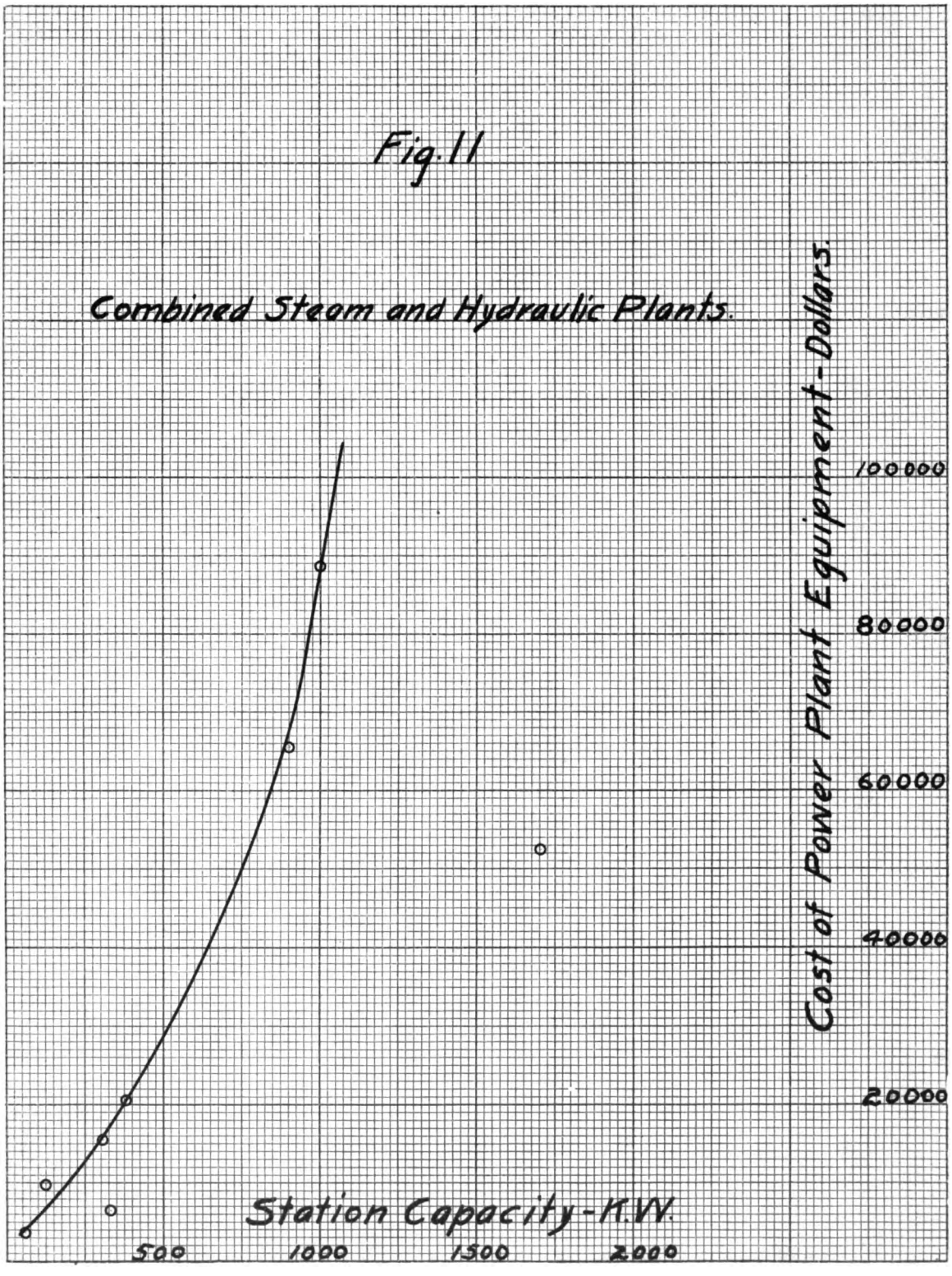


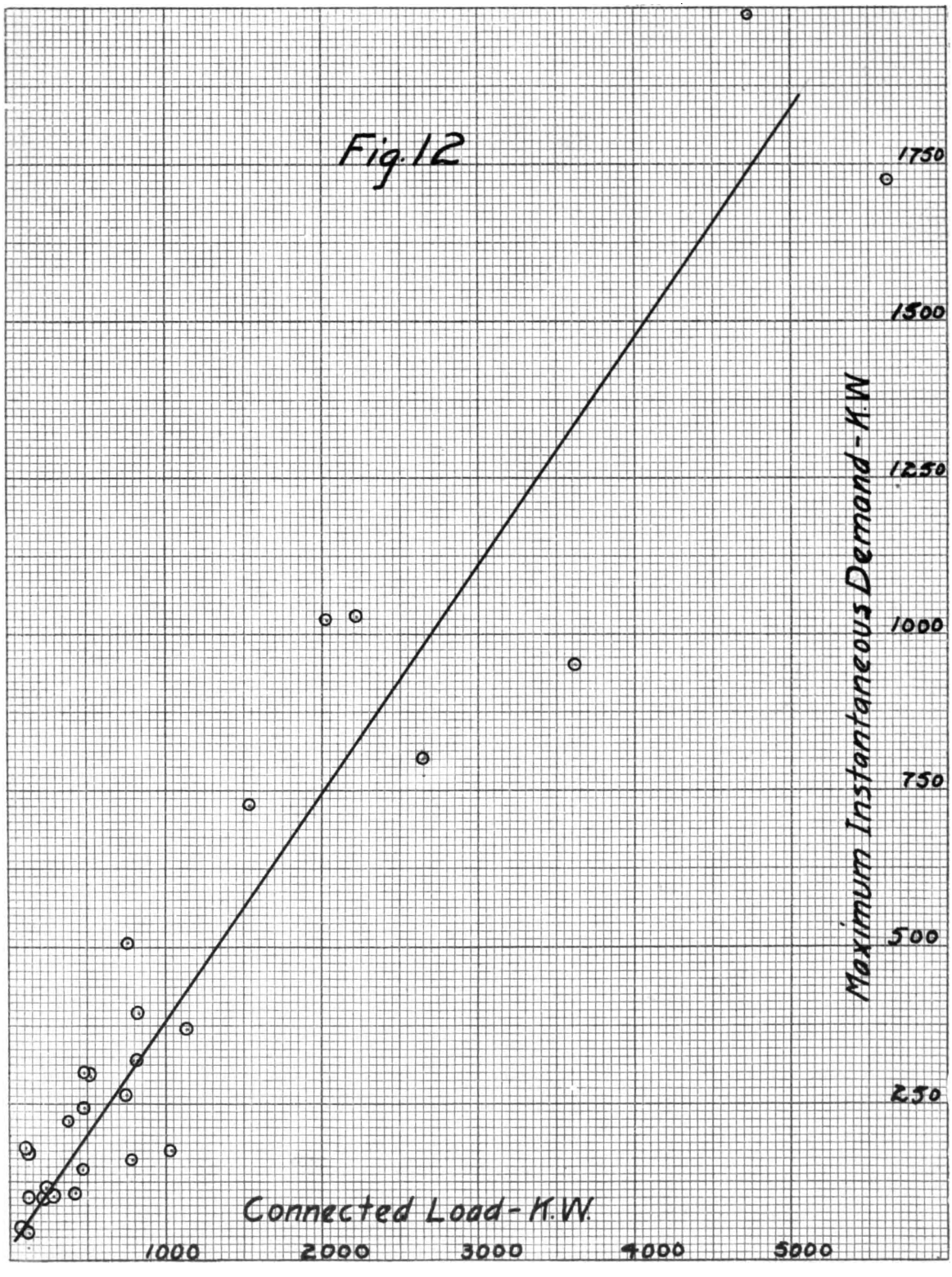


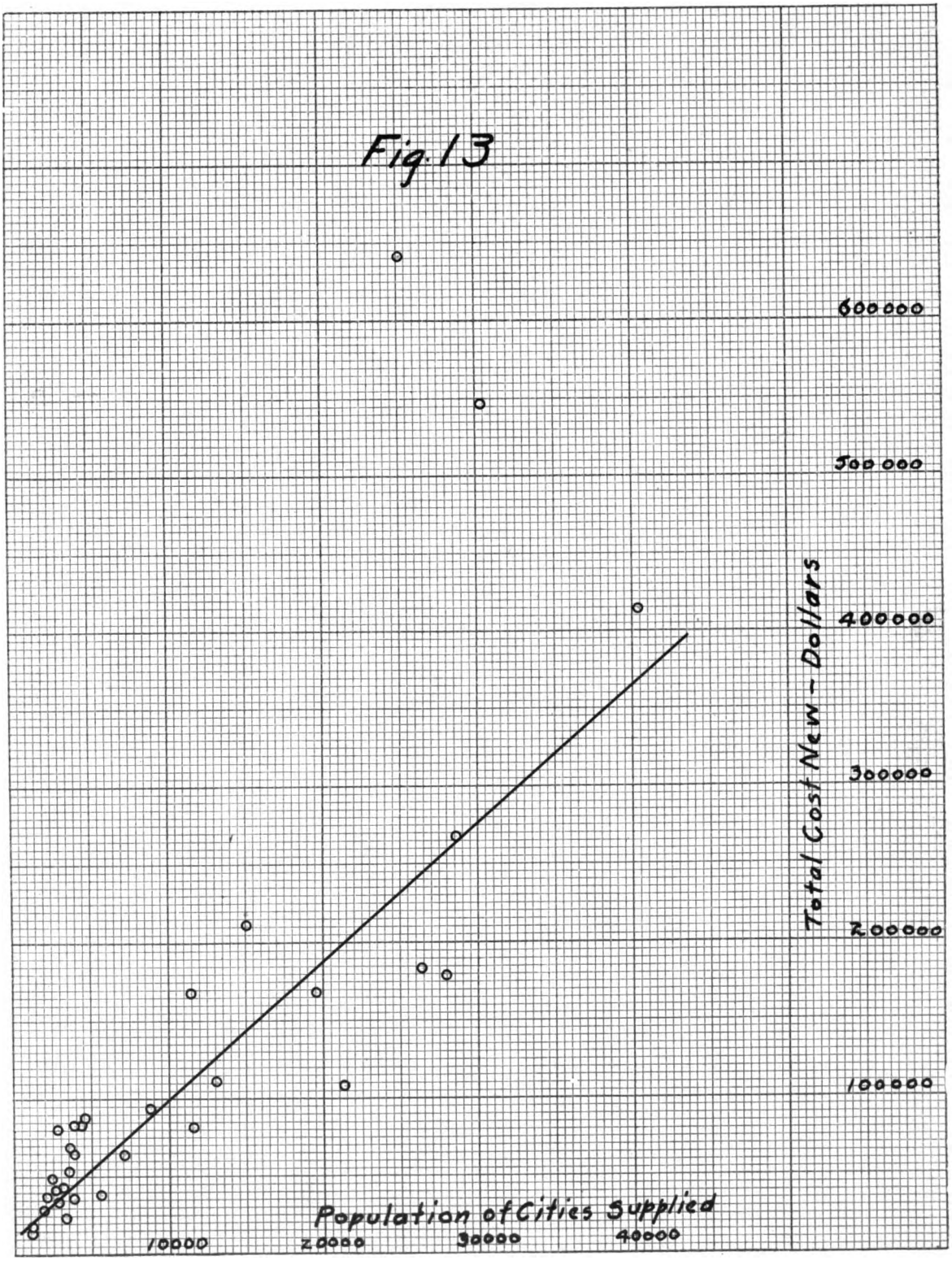












Approved by H. O. Watson
Asst Prof. Elec. Engg.
Edwin Gould

Statistician, Railroad Commission of Wisconsin

June 12, 1912.